HINTS

TO

HOUSEHUNTERS

AND

HOUSEHOLDERS

BY

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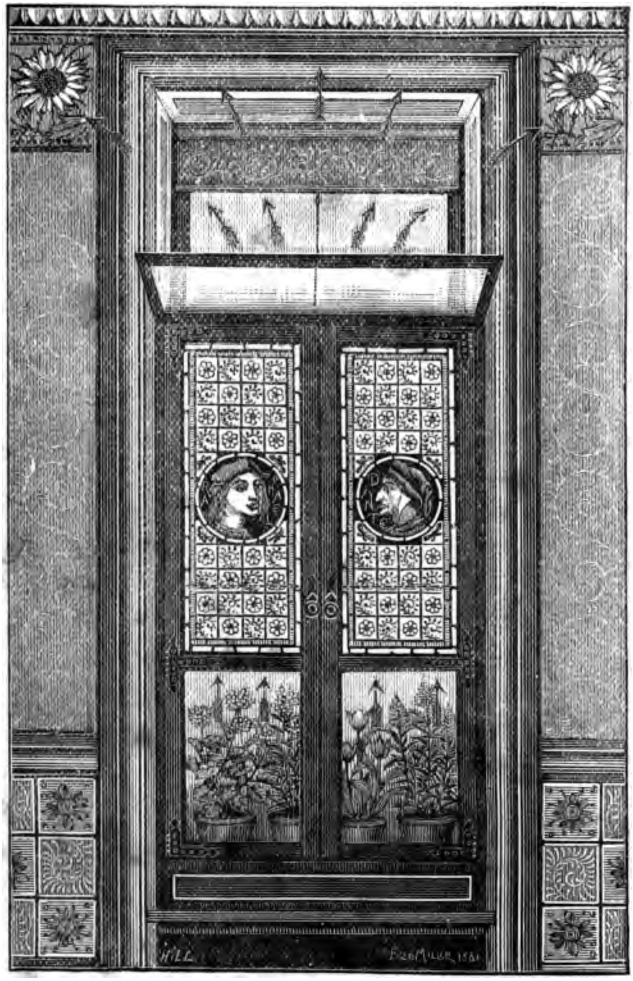

FLORAL ART VENTILATOR. *Page* 88.

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TO

HOUSEHUNTERS

AND

HOUSEHOLDERS.

BY

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TO HER ROYAL HIGHNESS

THE PRINCESS MARY ADELAIDE

DUCHESS OF TECK,

This Volume

IS

BY SPECIAL PERMISSION

RESPECTFULLY INSCRIBED.

PREFACE.

THIS little work has been written somewhat hurriedly; not because the subject was considered unworthy of care, but because the National Health Society was anxious that the volume should be completed in readiness for their Exhibition.

I have to thank various friends, literary, legal, and others, for their assistance in the task.

Of deficiencies there will doubtless be many; of inaccuracies, I trust but few.

Should any of my readers be disposed kindly to furnish me, in turn, with "hints" for the improvement of future editions, I shall be greatly obliged.

ERNEST TURNER.

246, REGENT STREET,
LONDON, W.
May, 1883.

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HINTS

TO

HOUSEHUNTERS AND HOUSEHOLDERS.

CHAPTER I.

HOUSEHUNTERS AND HOUSEHOLDERS.

Drawbacks of Householdership—The Sanitary Engineer—Smell-conservatism—What this book is not—What it is—The three C's—The Handy Book and its limits.

IN one or other of these two conditions — as househunter or as householder—the majority of adult mankind pass the greater portion of their life, sometimes too large a proportion of it simultaneously in both conditions.

Like most other conditions of mundane existence, those of househuntership and householdership have their drawbacks. There are people who maintain that the drawbacks even preponderate over the advantages, and that an extensive—and expensive—experience of both states has left them still in doubt as to whether the annual Lunacy Returns are more effectively swollen by the acute

aggravation of the one or by the chronic worry of the other.

And these ancient and prescriptive griefs, to which in the course of many generations the house-victim had become—as eels to skinning—more or less accustomed, have of late years received a new and far more terrible extension. To those natural enemies of his race—the landlord, or the tenant; the architect and the surveyor; the carpenter and bricklayer, and mason, and plumber, and British working-man in general—has now been added a yet more terrible and remorseless tormentor in the shape of the Sanitary Engineer. Always hard to get and bitter to keep, the ordinary house "of commerce" has now been plainly shown to be impossible to live in. Impossible, clearly, to live without ventilation; and the ordinary house is never ventilated. Impossibl*er* still to exist under the devitalising influences of damp or chill; and the ordinary house is an ingenious combination of the draught-trap and the sponge. Impossibl*est* of all even to contemplate existence under any condition of defective drainage or vitiated air; and what skill has been displayed in the construction of the ordinary house has been, as it would seem, exclusively exerted to keep the drainage from flowing out, and to let the sewer-air in.

And the matter was not improved by the fact that while the house-doctors, like other doctors, were all agreed as to the fatal character of the disease, they differed with remarkable unanimity as

to the remedy. Or so, at least, it has appeared to the unfortunate householder, present or prospective, who has not unfrequently been tempted to exclaim to rival sanitationists, "A plague o' both your houses! Let me grub on with my old smells in peace."

With this natural but undesirable phase of do-nothingness the work of the National Health Society brings it of course pretty constantly into contact. And it is continually being asked for some handy manual, not written in language or dealing with details such as "no fellow can understand," unless he has been brought up as a professional architect or a practical plumber, but just putting the plain facts in a plain way. It is for the benefit of such inquirers that the following hints have been put together.

Let it be clearly understood that they are Hints.

There are several things which this little volume is not, and does not pretend or desire to be.

It is not a "Treatise on Sanitation." That is a subject of the making of innumerable books on which there has of late years been no end, and much science has become a weariness not only to the flesh but to the spirit.

It is not a "Manual of Practice" for the Architect or the Surveyor. Of these too there is at least abundance.

Still less, if possible, is it a "Royal Road to Civil or Sanitary Engineering," or an "Every Man his

own Drain-doctor; with a few Easy Rules for the conversion of Foul Dens into Health-Palaces without cost of Time, Money or Education."

What it is its title-page proclaims—just "Hints" to the househunter and the householder. Simple suggestions in plain, every-day, intelligible English, on the various points of house-construction and house-arrangement which careful study and wide experience have shown to be essential to the health and comfort of a plain, every-day, intelligent Englishman.

Its general principle may be described compendiously, shorthand-wise, not as the three R's, but as the three C's—conciseness, completeness and simplicity.

It has been written at the request of the Society, and with the special view of providing its clients with a handy book of house-construction; which, without bewildering with abstruse calculation or technical phraseology, shall furnish sound and practical suggestions as to what to seek and what to avoid, how to "spot" defects and deficiencies, and how to get them rectified when "spotted."

More than this the non-professional house-hunter or householder cannot reasonably expect to be enabled to do. He can reasonably attempt to do more only where he finds himself oppressed by a hopeless superfluity of time and temper, and the victim of a passionate desire for the ultimate reduplication of his builder's bill.

And, finally, even as "Hints," the suggestions contained in the following pages do not claim to be altogether exhaustive of the subject. A volume which should aim at real exhaustiveness might, or might not, succeed in those endeavours, but would infallibly fail of remaining in any practical sense a "handy-book." The more reasonable requirements of the househunter and the householder, the more ordinary ills to which house-flesh is heir, have, it is hoped, been treated pretty thoroughly. It has been no part of the design to weary the reader with floods of superfluous detail upon points which it is thousands of chances to one will never present themselves, and which, if they did so present themselves, could neither be dealt with nor even understood without professional assistance.

CHAPTER II.

REQUIREMENTS.

Locality — Accommodation — A Royal Architect — List of Rooms—*The Dining-room*—Its size and aspect—Its dependencies—Buttery-hatch—*Morning-room* and *Breakfast-room*—Aspect—Outlook—" A fine view "—*Study* and *Boudoir*—" Fads "—*Library*—East or west aspect ?—Ventilation — Position —*Billiard-room*—Dimensions—Lighting by day, and by night—Trente-et-quarante lamps—Rigidity of floor — *The Smoking-room* — Aspect — Ventilation — Inlet and outlet—Reform Club experiment — Blowing too hard—*Bedrooms*—Draughts—The electric theory — The Alcove — *Nurseries and School-rooms* — Isolation — *Bath-room*—Floor — Walls — *Wine-cellar* — Ventilation — Temperature — Ante-cellar — *Coal-cellar* — How to estimate capacity—How to increase it.

THE first step towards getting what you want is to know what it is you do want.

So far as locality is concerned, this point will probably in most cases be more or less settled by circumstances. If not it must be settled by taste, or by such other criterion as may be adopted in its place. The general question of where to settle down, in town or country, seaside or inland ; Middlesex, Cornwall, Norfolk or Inverness, is one which

can be settled by no one but the settler.* There are still however some important considerations as to *Situation* (*see* chap. iii. p. 18), *Soil, &c.* (*see* chap. iv. p. 29), and *Water Supply* (*see* chap. vi. p. 44), which may afford scope for discretion, and in dealing with which it is in such case highly advisable to exercise it.

Probably, too, Cost (*see* chap. xiii. p. 149, and, if about to build, Construction (*see* chap. v. p. 35) may be an element in the calculation. And even if it be not, there can be no actual harm in knowing beforehand what you will have to pay and why you will have to pay it.

All these points settled as regards the locality of the proposed establishment, comes next the question of the house itself.

And here the first step is to make sure that your intended purchase contains the required accommodation. And to this end it will be well to check off its rooms, &c., by the following list. Nor is this by any means an excessive precaution.

It is one thing to have a general knowledge of the necessary rooms, staircases, &c., and quite another to apply that knowledge effectively to each particular case, as may be learned from the story of Gloucester House, at the corner of Park Lane. That commodious mansion, tradition tells us, was just completed, when, on removing the scaffolding with its ladders, it was discovered that H. R. H.,

* In the case of Ireland, it of course settles itself—in the negative.

accustomed no doubt to "Royal roads," had omitted from the design the merely mortal element of a staircase; for which a fresh purchase of ground had to be made, and a separate little house built on it, all to itself. Mere ordinary mortals are of course not likely to exercise forgetfulness on quite such a royal scale as this; but a harmless, necessary bath-room, or housemaid's closet, or possibly larder, may not inconceivably make its absence conspicuous only when the washing accommodation is actually required for morning bath or evening dinner. Of course it need hardly be said that every househunter will not demand all the accommodation noted in the list, which comprises all the requirements of a country mansion of the first class. The simplest plan will be to run the eye through it and put a pencil mark against the rooms, &c., desired in the particular case.

Family Apartments.

Billiard-room.
Boudoir.
Bedrooms.
Bath-rooms.
Cloak-room.
Conservatory.
Carriage Porch.
Dining-room.
Drawing-room.
Dressing-rooms.
Entrance hall.
Gun-room.
Garden entrance.
Luncheon-room.
Library.
Lavatory.
Morning-room.
Nurseries.
Porch.
School-room.
Smoking-room.
Saloon or Picture Gallery.
Water-closets.

Servants' Offices.

Ash-bin.
Butler's pantry.
Brushing-room.
Beer-cellars.
Brewhouse.
Bakehouse.

China closet.
Coal-cellars.
Cellars (miscellaneous).
Dairy.
Dairy scullery.
Drying-room.
Flour store.
Housekeeper's room.
House Steward's office.
Housemaids' closets.
Hot closet.
Ice-house.
Kitchen.
Knife-room.
Larders.
Laundry.
Linen-rooms.
Lamp-room closet.
Lumber-rooms.
Luggage-room.
Oven.
Scullery.
Soiled-linen room.
Safe.
Silver scullery.
Service-room.
Still-room.
Store-room.
Store closets.
Steward's room.
Servants' hall.
Shoe-room.
Servants' bedrooms and sitting-rooms.
Shed.
Wash-house.
Wood-house.
Water-closets.
Wine-cellars.

Having thus certified the presence of the required number of rooms, &c., the next point is to see if they are adapted to their several purposes.

The *Dining-room*, for instance, should not have in its outlook anything of south or west, but more especially of west. Its length should be determined by the maximum number of diners it is intended to accommodate, each of these requiring sitting-space of from a foot to fifteen inches in width.* The width of the room should not, in the smallest house, be less than 14 ft. 6 in., giving 4 ft. 6 in. to the table, 15 in. each for the two rows of seats, a similar space for any spare chairs left standing against the wall, and a

* It is hardly necessary to point out that, as the table has two sides, this seemingly insufficient allowance of space is really doubled, giving to each guest from 2 feet to 26 inches of sitting-space.

pathway of 2 ft. 6 in. all round the table for the service.

Next door to it should be the service-room, service-lobby, or, in smaller houses, pantry. And when there is a service-room it should always contain a hot closet for plates, &c.

It is well too that the kitchen should not be inconveniently distant. But the passage to it should on no account lead past the doors of any of the other living rooms. In this connection may be noticed by way of caution, a favourite amateur abomination known, incorrectly, as a "buttery-hatch." The real buttery-hatch—a contrivance for serving out rations from the buttery—was useful enough in excluding intruders from those sacred precincts. The hole in the dining-room wall nowadays dubbed by that name is simply an ingenious illustration of the old nursery conundrum, "When is a door not a door?"—but a happy combination of all its disadvantages with as little as possible of its convenience.

The *Morning-room* and *Breakfast-room* should be on the east or south-east side of the house, and the drawing-room, if there be only one, on the south side. If more than one, the greater the variety of aspect the better.

The windows of all these latter rooms should look out on something pretty. And, if the house be intended at all for winter occupation, especial care should be taken to provide a plentiful background of evergreens. But beware of committing

yourself hastily to a drawing-room with a "fine view." There are some people to whom such a possession is an abiding satisfaction, just as there are some who could not pass their lives more happily than in full court-dress. But with too many the prospect which is so delightful *in* prospect becomes in possession a real "old man of the sea." None but those who have made the actual experience can imagine the nuisance it and its inevitable "honours" may but too possibly become, more especially when it is a view which includes some one remarkable feature. It is when you awake every morning with the sense that before bedtime you will inevitably have had to reply at least a dozen times to the question, "Oh, can you really see the Crystal Palace?" that the relation between the camel's back and the cumulative straw-burden begins really to impress itself.

The *Study* and *Boudoir*, being of course the private "dens," respectively, of the master and mistress of the house, are altogether beyond rule, and must be governed by the individual "fads" of the intending occupant. All comfortable people have "fads;" all sensible people own to; all wise people humour them. Those who have none live most comfortably in an hotel. Those who think themselves "fad"-less cannot be more effectually undeceived than by a brief experience of hotel life.

The *Library* admits of some difference of opinion as to aspect, some persons preferring one to the

east; but on the whole west would seem most advisable. The library is not a room likely to be much used in the afternoon except in winter, or by some insatiable scholar, for whom it enters the "study" category, and becomes amenable to the laws of "fads." The principal uses, by the ordinary run of household or guests, will be as a morning letter-writing-room, and as an afternoon bad-weather lounge; and for either purpose a western aspect is suitable.

The library should be thoroughly well ventilated, or the smell of the books will become oppressive; and it should be specially free from damp, or the books themselves will rapidly become mouldy.

For position, the more isolated the better; especial care being taken that it should not be in any position to be made into a thoroughfare, and that it should not be within ear-reach of any room where music of any kind is ever carried on. It should therefore never communicate directly with the drawing-room or morning-room.

The *Billiard-room*, if intended ever to be used by day—and in every country house it is the recreation-ground in bad weather—must of course be sky-lighted, and is therefore of necessity either on the top of the house or to some extent detached from it—the latter being more convenient.

It must be at the least 24 ft. by 18 ft., and these dimensions will accommodate players only, not spectators; leaving a space of 6 ft. only round the table. For comfort there should be a

raised dais of at least 3 ft. 6 in. in width all round, making the room 31 ft. by 25 ft.

The skylight, or lantern light, as it is called, should entirely cover the table, and should be of the same size with it, viz., 12 ft. by 6 ft.

The night lighting is exceedingly important, and almost equally difficult. The main object is of course to ensure an equal diffusion of steady light, with no shadows and no dazzle to the eye. Fish-tail burners are too flickery; and argand, if used for gas, give out an enormous amount of heat, and require special ventilation. The best possible lamps for a billiard-table are those formerly used for the roulette and *trente-et-quarante* at Homburg and elsewhere, and still so used at Monte Carlo. They consist of four oil-burning argands, arranged in a square under a metal shade, with little turret shades, also of metal, for the upper parts of the chimneys, so that no illuminated point strikes the eye in looking down. The lower edge is further guarded by a dark "petticoat" of thick green silk, which entirely shields from the eye, when stooping, not only the lamps themselves, but all the illuminated under-surface of the shade. These lamps give a splendid light, cast no shadows, are thoroughly screened, and, being removed in the day-time, do not, like gasaliers or fixed chandeliers, intercept light from the skylight.

The floor of the billiard-room must be absolutely rigid—a serious objection to almost any attic room.

The *Smoking-room* is of course chiefly used at

night and in the winter. It should therefore have an aspect from south to west inclining westerly.

Like the library, it will require very special care in the matter of ventilation (*see* chap. viii.); and this not merely in respect of the amount of ventilation supplied, but in the nature and manner of it. Two points especially should be borne constantly in mind; 1, that the proportion of outlet to that of inlet space should be considerably larger in a smoking-room than in any other; 2, that a much greater necessity exists in its case for a carefully even distribution of the fresh supply. A curious illustration of this latter principle has recently been furnished at the Reform Club, where a fan worked by water had been newly put up in the smoking-room. But instead of driving out the smoke, the concentrated current from the new machine simply shouldered it out of the way; and, cutting a little tunnel straight to the opposite outlet, took possession of that outlet for its own exclusive benefit, the net result being that the smoke, which before escaped but imperfectly, now escaped not at all. And the too single-minded apparatus had to be incontinently removed.

Bedrooms also need careful ventilation, more especially with a view to keeping the sleeper free from draught.

They should be so arranged that the bed will not have to face the light, or to stand between window and fireplace, door and fireplace, or door and window.

Some people—strong in the all-importance of electric agency—maintain that the only possible way to sleep soundly and wholesomely is to lie north and south: that is to say, with head to the northward. There can at all events, *cæteris paribus*, be no harm in the adoption of this position. But the statistics of its physiological or sanitary results are not yet completed—or indeed begun.

Continental nations again,—who are constructed on different principles from Englishmen, and arranged to live without fresh air—are very fond of an alcove for the bed. To those who are thus constructed, it is a very convenient arrangement in many ways, and more especially in the facilities it affords in using the room in day-time as a sitting-room. From the purely sanitary point of view it can hardly be recommended, though no doubt it is possible to ventilate an alcove, as it is possible to ventilate a coal-mine.

Nurseries and *Schoolrooms* follow the rules of bedrooms, but should be as far as possible shut off from all other parts of the house: from the family and guest portion for the sake of the family and the guests; from the servants' territory for the sake of the children. This of course can only be thoroughly carried out in large houses, where the juvenile department of the building should always have its own distinct and separate staircase, passages, entrance, &c; but the principle should be borne in mind always.

Bath-rooms also require full and careful ventila-

tion; especially of course when supplied—as they must be, really to entitle them to the name—with hot water.

A fireplace is, in a room of this description, an essential feature too often omitted.

The floor of a bath-room should be specially well joined, or water will perpetually be getting down the cracks, creating a nuisance as well as rotting the joists.

A bath-room should never be papered; nor is panelling good as a wall-covering. There is nothing so good as paint, with tiles in the immediate neighbourhood of the bath itself.

The *Offices* may be disposed as may be found most convenient; but neither *Larder* nor *Dairy* should ever have either a south or a west exposure.

The *Kitchen* department is of sufficient importance to demand a chapter (*see* chap. xii. p. 128) to itself; as is also the housemaid's department (*see* chap. xi. p. 123).

For the Cellars:—

In the *Wine-cellars* one of the most important points is the ventilation—of which there should be none whatever. Any communication with the outer air is fatal to the interests of any delicate wine.

The temperature is also an all-important point; though not in the way in which the mere drinkers of wine are accustomed so to regard it. The actual number of degrees matters, in fact—except perhaps in the case of Madeira—comparatively little. The really important point is that the temperature,

whatever it may be, should remain so. A varying temperature is ruinous to wines.

Wherefore a wine-cellar should be kept as sheltered as possible from atmospheric influences of every kind, and should on no account be next door to the kitchen.

It should have an ante-cellar for bottling purposes. The door of this outer cellar should not be less than four feet in width, to allow the admission of wine-casks, which are three feet in diameter.

For a *Beer-cellar*, the chief qualifications are those of a great commander—coolness and capacity.

The *Coal-cellar* demands only the latter. This may be calculated sufficiently on the basis of 45 cubic feet for each ton of coal, but it will not do to take simply the dimensions of the cellar. Occasionally too the shoot is badly placed, which further diminishes the capacity. The best plan for getting the maximum of storage is to fill the doorway with a stout movable bulkhead reaching from the top to about a foot from the floor.

CHAPTER III.

SITUATION AND ASPECT.

Importance of situation—Defects not to be remedied—The top of a hill—The bottom of a hill—The best situation—Wrong kind of shelter—Too steep a slope—Surroundings—High hills and their drawbacks—Trees—Ponds—Lakes—Canals—Sluggish streams—A very bad neighbourhood indeed—A charitable nuisance—The railway nuisance—The night-cab nuisance—Sewer-flaps—Church bells, &c.—Climate—Contiguity no criterion—Bonchurch and Shanklin—Nice, Monte Carlo, Monaco, Menton, &c.—Climate by the sea—London specialties—May Fair and Belgravia—Belgravia proper—Belgravia by courtesy—Belgravia improper — London clay — Gravelly soils — Ghostly gravel—Real gravel—Good and bad sides—Situation for a living-house—Situation for a season-house—Sunshine potentiality—North, south, east or west ?—The House-agent's view—A floral compass.

FROM the sanitary point of view the situation and aspect of a house are two of its most important features. Defects of construction may be remedied. However serious, their removal is a mere question of skill and expense. Practical defects of situation or of aspect can only be overcome by the radical expedient of pulling the house down and rebuilding it elsewhere.

The top of a hill is healthy, but bleak; good for the strong and hearty; trying for the invalid; more trying still, perhaps, for the weakly constitutions which, unprotected by the privileges of recognised invalidism, are yet quite as unfit to cope with the rude climatic influences to which they are suddenly exposed.

The bottom of a hill is good—for no one; and cannot be made good. For though, in some cases, air may get to it, it is manifestly impossible that water can be got away. And a damp house is a deadly house.

The best situation, from the point of view of elevation, is the slope of a hill. And the nearer to the top—so long as it is not near enough to lose the benefit of shelter—the better. But then it must be the right slope, and the shelter afforded the right kind of shelter.

The N.E. face, for instance, of a lofty range may afford the most perfect facilities in the way of drainage; but the shelter of the hill behind is a shelter from sunshine, and sunshine is a very vital point.

About the perfection of situation is the slope of a not too steep hill facing between S.S.E. and S.W., high enough up to get a good fall for drainage and to be quite free from the miasma of the lower land; low enough down to secure thorough protection from the cold winds of east and north.

Very steep situations are objectionable even with this outlook. For the hill-side close at the back

tends to damp, impedes the free circulation of air, and makes the chimneys smoke.

Then comes the question of surroundings.

Lofty hills are not good as near neighbours. They draw rain and impede circulation.

Trees, especially fir-trees, are excellent neighbours—in their proper place. But their proper place is at some little distance. No single tree should ever be permitted to stand within some feet of a house; no plantation within several yards; no woodland, with its constant carpet of damp decaying leaves, within at the least half a mile.

Ponds, lakes, canals, and sluggish streams are bad neighbours always. The more they keep their distance, and the greater distance they keep, the better.

A "sewage farm" is a very bad neighbour indeed. Enthusiasts—and there are enthusiasts in sewage as in sweeter things—will boldly declare that the air from off a properly-managed filth-farm is as wholesome and as pure as that of any hill-top in the Middle Island of New Zealand. Let us not ruffle their susceptibility by a rude denial. But suppose the management should not be proper?

An hospital, again, is an unadvisable neighbour—particularly an hospital for infectious diseases. Nor is a cemetery desirable either in itself or in the saddening sights it necessarily brings.

A railway is a very bad neighbour, offensive to ears and nose, and anything but conducive to the prolonged stability of the house itself. This is a

point to which a new settler in honeycombed London will do well to look rather carefully.

Places of public amusement too may be shunned with advantage, as also public-houses.

And though, in the older parts of London, it is difficult altogether to escape the neighbourhood of that very objectionable neighbour, a mews, it is highly desirable to ascertain that the particular example of that class with which our proposed neighbourhood is afflicted is not the haunt of a proprietor of night cabs.

A sewer flap in the pavement opposite your front door or window may, when opened—as it is sure to be pretty often—be a great source of nuisance; nor is it advisable to select a house opposite one of those innocent-looking little oblong holes in the roadway by which the sewers are ventilated.

To some people the sound of bells from a neighbouring church or chapel is very objectionable.

Should it be summer-time when you are viewing a proposed residence, try to realise what its appearance will be in the winter, and *vice versâ.*

For the more general conditions of climate, &c., the only safe plan is to take special information. And let that information be of a strictly practical character. There are very few matters in which theory and fact are at wider variance than this matter of climate. And distance is hardly an element in the calculation. The widest differences

may be found in places only a few miles apart: Bonchurch and Shanklin, Brighton and Hastings, Capetown and Wynberg, Homburg and Nauheim, Lisbon and Cintra, Lausanne and Vevey; Nice, Monaco, Monte Carlo and Menton—examples might be multiplied *ad infinitum.*

Some few general considerations, however, may be borne in mind. As a rule—

The nearer the sea, the more equable the climate; the farther from it the greater the range and the more violent the alternations.

The east coast is bleak, the south warm, the west damp.

In choosing a London house many other points of situation must be considered. And, of them, two fundamental points:—

1. The object specially in view in selecting London as a place of abode.

2. The criterion by which the question is to be decided—personal convenience or popular fashion.

May Fair is still the "hub" of the London fashionable universe. Belgravia still occupies a good second place; this latter district again being divisible roughly into three sub-districts, which may be distinguished respectively as Belgravia proper, Belgravia improper, and Belgravia by courtesy.

Belgravia proper is, strictly speaking, bounded by Grosvenor Place, Buckingham Palace Road, Knightsbridge, and Cadogan Place. But the parallelogram formed by the western portion of

Knightsbridge, Princes Gate, the upper end of Sloane Street, and an imaginary prolongation of Pont Street, may now be fairly reckoned as part of it.

Belgravia by courtesy is less easily definable by boundary lines, being mixed up with Belgravia improper so intimately that it is highly advisable for a new-comer to ascertain on clear authority not only to which of the two any particular street belongs to, but, if it be on the correct side of the boundary, how long it has been there. In this Debatable Land—extending on the south to the river, on the west to Earls Court, and on the south-west to old "Cremorne"—a process of "development" is continually going on, and it is as well not to anticipate, or even too closely to follow it.

And so far as fashion is concerned this is likely to remain the position of affairs for an indefinite, or at all events an indefinable, period. Fashion must follow Royalty; and since the "Civil List" arrangement by which the Crown gave up its property, Royalty has had nowhere to move to, if it would.

From the health point of view the two localities are about equal. In natural position May Fair has greatly the advantage. But narrow streets, stuffy houses, a superabundance of stables and a deficiency of drains quite do away with any difference in its favour on that head.

As a general rule, avoid new neighbourhoods. They are generally cheap, but too often nasty.

The suspicion has of late occurred to some that the "London clay" has a peculiar, unwholesome exhalation of its own, and when newly opened up is exceedingly insalubrious. This suspicion has not yet been made the groundwork of any serious investigation, and may very possibly, when investigated, prove to be fallacious, but it is worth a thought; and the northern half of the metropolitan area is almost exclusively London clay.

The so-called gravelly soils of the south and west, on the other hand, are a snare of an even worse description. For too many of these districts are built, not upon the gravel, but upon the place where the gravel used to be, before it was dug out and sold for other purposes. And as houses cannot, remuneratively, be built upon a mere reminiscence, more substantial foundation is provided by filling up the place of the abstracted gravel with "rubbish" of a description more or less actively poisonous. But there are neighbourhoods—such, for instance, as South Kensington, Brixton and Stockwell—with pure deep gravel; and this is the best soil possible.

The worst side of a square or street is the west side. It faces the east wind, opens its principal windows lovingly to the "blacks," gets in winter time hardly a gleam of sun upon its living-rooms, and does not make up for that deficiency by the fact that in summer it has the sun full upon the windows of its only quiet bedrooms through all the hottest part of the day.

The best sides are—

For a house that is to be lived in all the year round, the north side, sunny in front and cool at the back.

For a "season" house, where the reception-rooms can hardly be too cool, and bed-time does not come till the sun is getting up again, the south side is by far the best.

At the seaside, situation will be governed by the same rules as in the country, with the important additional consideration of the sea itself. This, however, is a consideration too entirely dependent on personal taste for any general rule. But beware of a house immediately under a cliff. The chimneys could not help smoking if they wished it.

With regard to *Aspect.* Let it be borne in mind that sunshine is as essential to life as fresh air.

But as with fresh air so with sunshine. It is quite possible not only to have too much of that good thing, but to have even the right quantity at the wrong time, in the wrong manner, and in the wrong place.

To every room, therefore, in a house, there is, according to the service to which it is appointed, a good aspect and a bad—a best aspect and a worst.

The chief factor in the calculation is of course the number of hours of possible sunshine. And here the maximum for an ordinary-sized window, in a flat wall of ordinary thickness, may be taken

at about nine hours *per diem*. And, curiously enough, this is just the minimum time during which an average English sun keeps above the horizon.

A window facing due south therefore gets always as much sunshine as it can take in, and in midwinter all the sunshine there is to get.

The sun-supply of other aspects may be deduced from the following premises :—

On the longest day the sun rises E.N.E. and sets W.N.W.

At Lady-Day and Michaelmas the sun rises E. and sets W.

On the shortest day the sun rises E.S.E. and sets W.S.W.

The north front, therefore, of a house, gets an hour or so of sunshine, in the early morning and late evening, in the height of summer only.

The east front gets, always, whatever morning sunshine there may be up to 10.30 A.M., and no longer, the time of year affecting only the hour of commencement.

The south-east front has also the full benefit of the sun from his rising up to 1.30 P.M.

The south front, as we have seen, from 7.30 A.M. to 4.30 P.M. all the year round. That is to say, in midwinter, all the time the sun is above the horizon.

The south-west front from 10.30 A.M. to 7.30 P.M. (or sunset if earlier).

The west front from 1.30 P.M.—the hour at

which it quits the south-east front—to sunset, at whatever hour that may be.

The north-west front from 4.30 P.M. to sunset.

It is not always easy, however, to ascertain with any certainty what are the respective aspects of the different fronts of a strange house. Inquiry may of course be made of the agent. But it will be found that his views on the compass question are tinged with subjectivity. According to him all the four walls face south; not—of course—simultaneously, but successively; except—of course—the larder, which looks—of course—due north. It need hardly be said, however, that this monoscopic theory breaks down under the test of reduction to practice.

In a town, where the run of the streets is known, the thing speaks plainly enough for itself; as also where there is a fair view of a weathercock, which though pretty sure to be wrong with regard to the wind, is commonly more or less accurate in its points of the compass.

In the country the safest plan is to refer to your pocket compass.

If you do not possess this useful appliance you must guess roughly from the general look of things. For instance; a wall thickly covered with ivy probably faces north. One with a luxuriant Gloire de Dijon, or clematis or passion-flower, is almost certainly south to south-west. A Virginia creeper is doubtful, but suggests west.

Then—

IF the door (or window) by which you enter faces	THEN the side of the House		
	On your left hand faces	On your right hand faces	Opposite to you faces
N.	E.	W.	S.
N.N.E.	E.S.E.	W.N.W.	S.S.W.
N.E.	S.E.	N.W.	S.W.
E.N.E.	S.S.E.	N.N.W.	W.S.W.
E.	S.	N.	W.
E.S.E.	S.S W.	N.N.E.	W.N.W.
S.E.	S.W.	N.E.	N.W.
S.S.E.	W.S.W.	E.N.E.	N.N.W.
S.	W.	E.	N.
S.S.W.	W.N.W.	E.S.E.	N.N.E.
S.W.	N.W.	S.E.	N.E.
W.S.W.	N.N.W.	S.S.E.	E.N.E.
W.	N.	S.	E.
W.N.W.	N.N.E.	S.S.W.	E.S.E.
N.W.	N.E.	S.W.	S.E.
N.N.W.	E.N.E.	W.S.W.	S.S.E.

N.B.—In the actual mariner's compass there are also sixteen intermediate points: e.g. between N. and N.N.E.—N. by E.; between N.N.E. and N.E.—N.E. by N. But in practice such delicacy is neither necessary nor attainable.

And, finally, as regards weather in general:—

A *northerly* aspect is always bleak and cold, and almost always damp.

An *easterly* aspect is cold, especially in the spring; but it is fairly dry, though a good deal of rainy weather comes at times from the south-east.

A *southerly* aspect combines as much of warmth, dryness and sunshine, as the peculiarities of the climate will in any way allow.

A *westerly* aspect is warm, but inclining to damp, and exposed to the most boisterous and rainy gales which, especially on the Channel coast, come almost always from the south-west.

CHAPTER IV.

SOIL.

Ground-air—Digging up carbonic acid—Movement of ground-air—Poisonous soils—Poisoned soils—Geological survey map—Our neighbours' nuisances—The moral of it—Ground-water—Damp soil—The phthisical theory—A doubtful advantage—Amateur drainage—Absorption of heat—Herbage—Radiation of heat—Healthy soils—Unhealthy soils—Made soils.

"THE earth hath bubbles, as the water hath." Real air-bubbles, and many of them. Loose sand often contains from 20 to 40 per cent. of air; and the surface soil we dig up in our gardens is simply gorged with it. It is a point to be borne in mind too, in connection with the popular but erroneous idea of the extreme deadliness of carbonic acid, that this air which we thus, when "gardening," set free from the soil, and the breathing of which is universally allowed to be so excellent for the health, is abnormally "rich" in that particular constituent.

And not only is the earth under our feet full of air, but that air is in continual motion, which varies considerably; the agencies governing its

variation being the amount of rainfall, increase or decrease of barometric pressure, and the rise or fall of temperature.

This last is a very potent factor, and moreover one of especial importance from the fact that it forms the chief cementing link between the soil-atmosphere and ourselves. An inhabited house is a sort of gigantic cupping-glass, and the heat-rarefied atmosphere of its rooms is continually replenished from the air stores of the soil, forced up syphon-wise by the excess of weight in the corresponding column of cold air outside.

Hence to live on a poisonous soil is to breathe poisonous air.

Some soils are naturally poisonous. For the most part these soils have other defects which, by making building impossible, act as safeguards. But the "London clay" is a doubtful soil upon which building is very possible indeed. Fortunately, even at its worst, it purifies itself in time, under exposure to the air. So it is only those who are living in the immediate neighbourhood of digging operations, or move into one of the new houses directly it is finished, who are practically exposed to any hurtful influence on that score. There is only one remedy, but that is fortunately within the reach of all: viz., not to take a house either newly built on the London clay or just on the edge of advancing brick and mortar tide.

Again, soil naturally wholesome may be made poisonous by ourselves, and is very conscientious

in returning the poison we have committed to its keeping. Cesspools and drains are the principal agents in this procedure, and their agency is dealt with in chapter vii.

Or, possibly, as pointed out in the preceding chapter, an artificially poisoned soil may have been carefully provided by the original owner of the estate.

Bear in mind, therefore, that the indications of the Geological Survey Map are not necessarily conclusive as to the actual soil.

And, finally, the poison may have been provided by a neighbour. Air currents do not travel through the soil as rapidly as over it; but they travel just as surely. And the more naturally wholesome the soil —such as gravel or sand—the more readily they penetrate it. So the poisoned air from a cesspool, or drain-polluted patch, a score of houses off may find its way underground, and so into your basement and your lungs, be your own drainage system as perfect as it may.

And the moral of this is: *keep out all ground air from the house.* Never build—or at all events never for your own use—a house without a solid substratum of impervious concrete under the whole of it, and extending some little distance beyond the walls on every side.

Soil also contains water.

Chalk holds from 13 to 17 per cent.; clay, unless of a very stiff kind, 20 per cent.; and humus or mould 40 to 60 per cent. The only soils that contain no

water are trap or metamorphic rocks, unweathered granite, hard limestone, dense clay, and the like.

And, like the ground air, this ground water is in constant motion. Only in its case the movement is in one uniform direction, that of the sea or the nearest water-course. This movement is much impeded by the roots of trees. Hence, when these are grubbed up, the water runs away more readily and the soil is drier.

A damp soil has a tendency to the promotion of rheumatism, catarrh, neuralgia and phthisis. There is a popular superstition that a malarious soil does not tend to the development of this latter class of disease. But as the way in which it does, no doubt, to some extent reduce the number of deaths from that cause is simply the killing off of its otherwise predestined victims by a more rapid process, the gain is on the whole rather apparent than real.

A moist soil has also a tendency to the development of paroxysmal and enteric fevers, cholera, dysentery, *et hoc genus omne.*

Therefore *avoid a damp soil.* If you can't avoid it, drain it; and drain it effectually, or your drainage will be a costly farce. How this is to be done in each particular case is a problem on which you will do well to take professional advice. Amateur drainage is generally effective only as regards the pocket of the experimenter.

Finally, soil also absorbs heat, retaining or returning it in various proportions.

Shübler ranges these proportions as follows; taking sand with lime in it as his starting-point, with an absorbent capacity of 100.

Pure Sand	95·6
Light Clay	76·9
Heavy Clay	71·11
Pure Clay	66·7
Clayey Earth	68·4
Gypsum	73·2
Fine Chalk	61·8
Humus	49·0

Herbage greatly lessens this absorbent power in all cases.

The influence of this absorbent power is felt in the comparative warmth, or otherwise, of the night temperature; and it is the greater in that the soils which absorb heat the most freely are also the slowest to give it off again. A clay soil thus becomes cold very soon after the sun ceases to heat it. A sandy soil continues to give off warmth all through the night.

The most healthy soils are: granite, metamorphic, and trap, chalk, sandstone, deep high-lying gravel, and stiff, *well-drained* clay.

Limestone and magnesian limestone are healthy if free from marsh; but this is a point to be very carefully ascertained.

Sands are healthy when deep and free from organic matter. But sands like those of the French Landes, full of vegetable sediment, are bad.

Undrained clays, stiff marls, and alluvial soils generally are bad.

"Made soils" are always suspicious and commonly deadly. They should never be built upon for at least three years after formation, and then only if the ground-water has throughout been freely drained through them.

CHAPTER V.

CONSTRUCTION.

The three requirements—The concrete shield—Rotting of timbers—Thirsty bricks—The bottom of the pond—How the moisture comes—The capillary climb—The æsthetic soak—Overgorged gutters—The sparrow-demon—Damp-proof courses—Bad made worse—Protection of parapets—Washes and their worth—The test of the brick—Jointing and pointing—Hollow walls—The air blanket—Chilly bedrooms—Areas—Air drains—Expensive economy—Double windows—Roofs—Tile—Slate—Pitched too high—Flat roofs—A roof on the crawl—Zinc—Shilling *versus* threepenny piece—An unpremeditated battery.

HAVING settled the sort of house you want, and the place where it is to be, the next thing is the fabric of the house itself.

A house to be either comfortable or healthy, should be—

Warm in winter.

Cool in summer.

Dry always.

If it fail in either of these three respects, that is a fault of construction—and a fatal one. The worst failure of all is in respect of the third requirement. A damp house is a deadly house.

The first step towards securing this desirable drought is to cut off the house from the damp soil, which should be done by covering the whole surface of ground occupied by it—and, if possible, with two or three feet to spare, all round—with a layer of concrete at the least from four to six inches thick. And this should be thoroughly and carefully done, the ground being previously properly levelled.

The joists should so be laid as to leave a foot of space between the concrete and the floor, and gratings inserted in the walls, so as to give a free circulation of air. This also protects the timber from rotting.

Then, the house generally being thus protected, the walls will have to be supplied with individual protection in their turn.

A common brick will absorb and contain within itself a clear pint of water.* In an ordinary eleven-roomed house there will be, say, from 120,000 to 150,000 bricks—that is to say, the walls of such a house will, if saturated, absorb and retain some 17,000 gallons of water. But for the "honour and glory of the thing," and the lack of gills to breathe with, the inhabitants of such a house would not be very much worse off at the bottom of a moderate-sized pond.

And the ways in which the walls may get saturated are six.

* According to Professor Ansted, granite will absorb about 1½ pint to the cubic foot, or about one-tenth of the amount sucked up by brick.

1. *By moisture from the ground.*

It is a popular superstition—based on strictly scientific fact—that water will always find its own level—that is to say, will always sink as low as it can.

This is, in fact, one of the "laws of nature," and, like all other such "laws," always holds good—till another "law" happens to interfere with it. The law which in this case interferes with that of gravitation is the law of capillary attraction. And under the influence of this law, water, or any similar liquid, instead of sinking as low, climbs as high as it can; as may be seen if you put a lump of sugar into a wet saucer; or felt if you build a wall in a wet soil.

2. *By rain falling on window-sills which do not project beyond the walls, and are not constructed to throw the water clear of them.*

Modern æsthetes rather favour this particular form of insanity.

3. *By rain falling on projecting portions* of the wall itself.

Cornices, æsthetic architraves, and other ornamental features of the kind, are very effective damp-traps in this way.

4. *By parapet walls, gables, or dormers, not being properly covered with coping.*

Here gravitation and capillary attraction join hands, and the wet soaks downwards merrily.

5. *By overflows from imperfect roof gutters, or rain-water pipes.*

Or even from perfect ones, when the supply of sparrows' nests is in excess of the demand.

6. *By the comparatively legitimate process of rain beating on their surface.*

The first of these sources of damp-supply may seem at first sight difficult to deal with, because, in the present stage of architectural science, it is found absolutely necessary that the lower portion of the walls should be more or less in contact with the ground. The problem, however, is solved by the introduction of a "damp-proof course"—that is to say, of damp-proof material carried through the whole thickness of the walls, above the highest point at which the ground is touched.

A damp-proof course may be formed of—

1. Two or three courses of hard blue Staffordshire bricks laid without mortar. This plan obtains pretty generally in the Midland counties.

2. Perforated stoneware slabs, examples of which may be seen at many of the London, Chatham, and Dover Railway stations.

3. A layer of good asphalte, from three-eighths to three-fourths of an inch thick. This is an excellent plan, and in good buildings is now more used than any other.

4. Sheet lead. Also an excellent material, but costly.

5. A cheaper substitute, in the form of two layers of ordinary roofing slate, in cement.

In one or other of these forms, or any other efficient equivalent ingenuity may suggest—a damp-

proof course should be insisted upon in every house; and it should be laid six inches above the highest point of contact with the ground.

The floor timbers should be laid above the damp-proof course.

Window-sills which do not project—technically termed "flush sills"—are at present held to be "æsthetic," which of course renders the question of mere practical disadvantages immaterial, if not impertinent. There can, however, be no absolute harm in pointing out that when they are made of brick the rain soaks down, sufficiently through the bricks themselves, freely through any defective joints. When they are of stone, it dribbles down the walls, soaking in, of course, as it goes.

The evils thus arising may be obviated very easily, but only in one way—by not using this form of sill.

The soakage from rain falling on cornices and other projections is often ingeniously aggravated by the use for these features of a softer kind of brick. Nothing can really protect them except the covering with some sort of waterproof material; but the mischief may be mitigated by sloping the top downwards from the face of the wall. With time, however, the mortar joints inevitably become defective; then the frost steps in to widen the breach, the mortar becomes disintegrated; little channels are formed, and the work is done.

Soakage in the fourth manner, through unprotected parapet walls, gables, &c., may be counter-

acted by the simple expedient of protecting them. Every such wall should be topped with a projecting slab of stone laid, in the case of a flat wall, at a slight inturned slope.

Similarly, the overflow from pipe or gutter must be treated by clearing out, mending, or renewing, as the case may be.

The straight beating of the rain is in most cases a minor evil. Through the perpendicular face of a wall the soakage is but slow, most of the water running off as fast as it is poured on.

A much exposed wall, however—as at the seaside—may be protected by a coat of cement, or, in extreme cases, by covering with slate.

There are also sundry kinds of washes, but few of these are of any great practical value.

None but *hard* bricks—bricks that ring when struck with a trowel—should ever be used for walls.

All joints should be thoroughly *filled* with good mortar or cement. Much labour may be saved and the work greatly expedited by substituting just a little dab of mortar along the outer edge; *but the gain is entirely to the builder and his men.*

Hollow walls are admirable things in every way. They are constructed of two thicknesses of brick with from two to three inches between, and banded together by ties either of iron or glazed stoneware, or other impervious material.

In a hollow wall the intermediate layer of air acts as a blanket, and keeps the temperature equable—warm in winter, cool in summer.

If not built hollow, walls must be built *thick*, or an equable temperature cannot be obtained. A thin-walled house is hot in summer and cold in winter.

The upper stories of houses are very commonly too thinly walled—whence chilly bedrooms.

When a basement or sunk storey is necessary, there should be a good wide area around it, the floor of this area being at least six inches below that of the basement. Where an open area cannot be obtained, its absence may be partially compensated by what is known as an "air drain," which is in fact a covered area only a few inches wide, but drained and ventilated.

There are few more expensive "economies"—to the householder—than cheap thin window-glass, through which the warmth of a room escapes as water through a sieve. Good thick glass very soon recoups itself in coal; and better still is the double window, or even, *faute de mieux*, the double pane, with the comfortable air-blanket between.

Roofs may be covered with—

1. *Tile.* Excellent non-conductor, but heavy, and therefore costly, as requiring stronger timbers; and sometimes absorbing moisture, which is communicated to rafters and laths, causing decay.

2. *Slate.* Light and durable, and, when properly laid and secured, quite impervious to weather, but not so cool as tile or so warm. It should have a lap of 2½ to 3½ inches, according to position and pitch of roof. The "lap," be it understood, referring to the

portion covered by each slate, not of the slate immediately under it, but of the one next under that.

In all slated roofs the rafters should be first boarded over, and the boards then covered with asphalted felt, before the slates are laid on.

Steepness of pitch helps to throw off rain and snow; but too great steepness entails heavy timbers, necessitates the carrying up of lofty chimney-stacks, and exposes a large surface to the wind.

For flat roofs the best covering is sheet lead; but it does not do for pitched roofs—in fact, won't stay there. Professor Tyndal relates in his work, 'Heat as a Mode of Motion,' how, even on the very moderately inclined roof of Bristol Cathedral, the lead "crawled down" eighteen inches in two years. On the nice sunny days it expanded comfortably in the sun, the downward drag of its weight assisting the expansion. When the cold nights came it contracted again. But this time the downward drag of the weight pulled the other way, and resisted the contraction. Which was a very pretty process from the scientific point of view, but unsatisfactory to the Dean and Chapter.

The other covering for flat roofs is zinc, cheaper in first cost—commonly costlier in the long run. When used it should be in sheets of the thickness of a shilling. It is often put on no thicker than a threepenny-piece. The sheets should never be soldered together, and still less, if possible, should they be fastened with copper nails. The result of

this latter arrangement, which has been known to occur to the mind of a too-ingenious plumber, is of course to provide an electric battery of an indefinite number of cells. For which the acid of the rain obligingly supplies the necessary "excitement."

The general quality of material and of workmanship—one of the most important points, it need hardly be said, of all—is a matter quite beyond the range of any "Hints," as it is beyond the capacity of any but a trained experience.

CHAPTER VI.

WATER-SUPPLY.

The Duke of Westminster's letter—Supply per head—Cistern capacity—Tubbing and bathing—The ball-cock—Cisterns—Material—"Used for drinking purposes"—Jack Frost—Empty pipes and full cisterns—Periodical cleansing—Covers—Position — Pipes—Accessibility of — How not to do it—Plan of water-pipes—Leakage—How to "spot" it—A Titanic stethoscope—Quality—Nice and not nice—"Creatures"—Filtration--Charcoal under the microscope—Silicated carbon—Soft water—Roof supply—How to make it available—Natural impurity—Quantity—Average—How to estimate—Tanks—Below ground and above—Burst boilers—Pumps and wells.

IN the sanitary arrangements of a house there is no feature of more importance than the water-supply.*

* With reference to this important point, as it affects the metropolis, it may be worth noting that the following letter has recently been forwarded to the Home Secretary by the National Health Society, signed by the Duke of Westminster, president of the Society: "Sir,—I am desired to express the satisfaction of the National Health Society at the announcement that Her Majesty's Government have determined to bring forward a measure for the improved local government of the metropolis; and they do so in the confident expectation that it will make provision for the removal of those conditions of disunity in the present local administration

The advantages of a "constant" over an intermittent supply are too obvious to require stating. In London some districts are supplied in this way, but they are very few. If possible, pitch your tent by preference in one of them.

The amount required depends to some extent upon the habits of the occupant; but a full healthy provision, with due allowance for the minimum of

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which have long proved so detrimental to measures for the improvement of the health of the population. I am to transmit herewith, for your consideration, copies of the representations that, with general public support, the association have heretofore submitted to your predecessor on the principles of the amendments needed especially in respect to the conditions of the water-supply of the metropolis; and I may now add as to its drainage, which may be thus summarised. That measures should be taken for the prevention of the stagnant detention of water in cisterns, by which good supplies are made bad, and bad supplies are made worse; that supplies from improved sources should be carried direct and constantly into every house, and the fouled water constantly removed by self-cleansing drains or channels from every house, and from the town, by works under one and the same authority, and that authority a public and responsible one. That the success of any administrative measure for the sanitary improvement of the metropolis will be dependent on the competence, in science and skill, of the executive officers employed; and that it is requisite that adequate securities should be provided to insure such competence in all new appointments. That it is the confident belief of those conversant with sanitation that the cost of efficient measures for the reduction of existing excessive death rates will, under efficient administration, be less than the present incurable burdens arising from excessive sickness and mortality. I am to state further that the sanitary authorities are agreed that the annual money burdens of excessive sickness and excessive numbers of funerals from premature mortality in the metropolis exceed what would be the annual charge of efficient preventive works, which can only be obtained by a properly constituted public authority under a complete unity of administration. I have the honour to be, ir, your obedient servant, WESTMINSTER.—April 13, 1883."

effective "tubbing," cannot be estimated at less than twenty-five to thirty gallons per head. A single full-sized bath will consume from thirty to forty gallons.

In calculating the supply provided, it may be taken that a cubic foot of cistern will accommodate rather more than six gallons. There should therefore be at the least from four to five cubic feet of cistern for the uses of each inmate of the house.

To ascertain the amount of water held by any cistern, multiply its inside length by its inside breadth, and the result by the depth from "high-water mark;" that is to say, from the lower part of the ball when raised just high enough to cut off the water. There is sometimes a very considerable difference between the depth from this point and the apparent depth as taken from the top of the cistern. Then multiply the total by six, and the result will be approximately the actual contents in gallons. Or divide it by five, and the result will give the number of persons to whom it is capable of supplying the minimum amount of water required by the demands of health and cleanliness.

It is needless to say that this allowance limits the daily "tub" to a sponge-bath, and that on an economical scale. It is tolerably obvious that a daily demand of thirty gallons for a real bath, would not leave—out of a total supply of twenty-five gallons—much for cooking, drinking, and other purposes.

The data on which the minimum of twenty-five gallons is fixed are—

	Gals.
Domestic supply (without baths or closets) . .	12
General baths	4
Water-closets	6
Unavoidable waste	3
	25

It is well, having ascertained that the theoretical supply is on the proper scale, to take two simple but unusual precautions, to ensure: (1) that it is not reduced; (2) that it is not, at some unexpected moment, inconveniently increased.

First, see that the ball-cock itself is properly fixed. It is sometimes so insecure as to droop even with its own weight; and very often not strong enough to resist the assaults of some energetic domestic, who, finding that the apparatus, for lack of a drop or two of oil, does not work freely, forcibly thrusts down the ball—and the cock with it.*

Then sling the ball, by a small piece of chain, so that it cannot droop too low, or it may possibly not get back when required.

The result of the latter difficulty is, of course, an overflow. The result of the former, a chronic diminution in the daily supply. Neither accident will happen where workmanship is good. But it

* The term ball-cock is used here as being that most familiar to our readers. The proper apparatus nowadays is, of course, the ball-*valve*, which is superior in every way.

is not safe to assume that workmanship is good—ever.

A good deal of discussion has of late years been carried on as to the best material for cisterns. Lead has been condemned as dangerous, and there are, no doubt, certain qualities of water—notably the purest and most highly oxygenated—which are injuriously affected by contact with that metal. All kinds of expensive substitutes have been suggested—slate, glass, and the like. But in this particular matter the cheapest material does as well as the dearest. There is no sanitary or scientific reason why slate or glass should not be used, or gold or Dresden china; but plain galvanised iron is quite good enough.

No cistern used for drinking purposes should ever be in direct communication with any portion of the apparatus of any water-closet.

And here it is as well to define the term a cistern "used for drinking purposes." This is commonly supposed to mean a cistern from which the servants are instructed to draw the water for drinking. But mere "orders" have no more effect upon the purity of the water than upon the action of the servants. The cistern "used for drinking purposes" will in all cases be the cistern nearest at hand, when water happens to be wanted.

Frost should be guarded against. And this may be done to some extent by protecting all water-carrying pipes against the weather. It is always safest, however, in time of frost, to "take a bond of

Fate," and empty them; the drawback to this precaution being that there is then no further water-supply.

This may be remedied by placing a valve at the cistern end of the pipe, and ventilating the pipe itself by a small air-pipe carried up above the water-level of the cistern. By closing the valve, and opening the service tap, the pipe can then be cleared of water without lessening the supply in the cistern.

Every cistern should be easily accessible both for inspection and for cleansing, which latter operation should be thoroughly performed at least every three months.

Every cistern should have a good well-fitting cover.

Cisterns should not stand under skylights.

All pipes should be thoroughly accessible. By which is *not* meant the covering them over with a board, firmly screwed to the wall, and the screw-heads carefully puttied and painted out of sight; or perhaps the board itself painted over. The covering-board should always be on hinges, and should open as readily as any ordinary cupboard-door.

To retain the heat in pipes used for the conveyance of hot water—not of course in pipes intended for the *transmission* of heat—cover them with a jacket of felt. This is also an excellent protection against frost.

It is a most excellent precaution to have a plan of the water-supply of your house, showing all pipes, taps, traps, &c.

Very few people have any idea of the amount of leakage which goes on from pipes under house-yards, &c. Remember, underground leakage makes the soil damp, and undermines the foundations of the house.

To "spot" underground leakage: shut off all drawing-taps, and tie up the cistern ball-cocks. Then take a stethoscope—the kitchen poker makes a capital one—rest one end upon various exposed parts of the suspected pipe, and rest your ear upon the other. The point of the poker will be found most convenient for the first, and the knob for the second. Then if you hear a slight hissing noise anywhere you may assume that there is a leak somewhere near.

The *quality* of water is a very big and still more complicated subject—much too big and too complicated to be dealt with effectively *en amateur.*

One point, however, may be borne in mind. If water be nasty it is, except sometimes from the medicinal point of view—undoubtedly bad. But the converse of the proposition does not hold good. Water is not necessarily good because it is nice—not by any means.

Pure water shows as free from "creatures" of any kind under the microscope as to the naked eye, but polluted water often swarms with minute organisms.

In towns no water should ever be used for drinking purposes until it has been passed through an approved filter.

Filtration is a very delicate subject. The majority of filters are pure delusions. Some are useful for a time as strainers, but have no other action; and almost all are apt to get rapidly out of order. and to pollute the water instead of purifying it.

Charcoal, especially, so much vaunted as a filtering medium, requires frequent renewal. The Rivers Pollution Commission reported of one highly-approved house-filter that "myriads of minute worms were developed in the animal charcoal, and passed out with the water when the filters were used for Thames water, and the charcoal not renewed at sufficiently short intervals."

The filtering medium, whatever it may happen to be, should always be readily accessible, and should be thoroughly cleansed at least once every six months.

Fig. 1.

Without pretending to decide too dogmatically on this delicate point, I may say that the filter

I myself most commonly use in practice is the Silicated Carbon.

For table purposes and general detached use the Spongy Iron is no doubt also a very good filter, and the Magnetic Filter of Dr. Spencer is very highly spoken of. But a special advantage possessed by the Silicated Carbon Filter is its great adaptability, and the facility with which it can be worked into the general water-arrangements.

The superiority of soft to hard water for all purposes of washing, cookery, and the like, is incontestable and enormous. The mere money saving in such articles as soap, tea, and so forth, is a serious consideration; while everything is much better done.

Of *soft water*, the simplest and readiest source of supply is that from the roof. Needless to say that in London or any large town this source of supply is practically unavailable.

An ingenious apparatus, of which the following is a sketch, was patented not long since for the separation of the first downpour, containing the sweepings of the roof, from the after-fall, which is practically clean enough.

The "Separator" is balanced upon a pivot, and divided into two compartments. After passing through the strainer the water falls into the first compartment; this has a small hole at the bottom (proportioned in size to the area of the roof) through which the water passes into the discharge pipe. When the rainfall is more than can pass through

this hole, the water rises till it reaches two small holes, through which it flows into the second com-

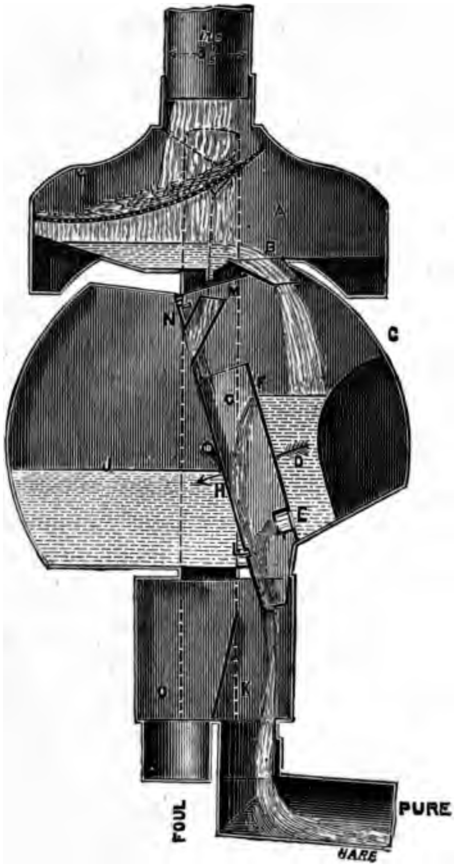

Fig. 2.

partment. This compartment fills very slowly, because the water escapes therefrom almost as fast

through a hole at the bottom. When the second compartment has filled to a certain level the Separator overbalances, and the discharge is directed to the storage tank. When the rain is leaving off the second compartment is kept full by an auxiliary pipe, so that the Separator remains canted after the water has ceased to pass from the first into the second compartment; and thus the last drop of rain is utilised.

It should be borne in mind, however, that rain-water itself, however carefully collected, is by no means so pure as, considering its origin, one is apt to think it should be. Of course its apparent is not exactly its real origin. Before it can "come down from the sky" it has to be drawn up there. Again, before it reaches us it falls through an atmosphere charged with smoke and other impurities.

In all cases it varies very greatly in amount; the variation being directly as the raininess or otherwise of the season. It may also be safely reckoned upon to reach its lowest point at the time when the largest supply is needed, and *vice versâ*.

To calculate the probable average: multiply the length of the house or other building by its breadth—outside measurements of course in both cases—and adding, say, a foot to each for eaves and gutters. Divide the total by two. The result, multiplied by the number of estimated inches of local rainfall, will give, approximately, the number of gallons due annually from the whole area of roof.

If you wish to be very scientific, instead of simply

dividing by two, just multiply by 144, and then either divide the result by 277·274 or multiply again by ·003607. But when you have done so there will be no harm in bearing in mind that this theoretically more accurate result will practically be most likely wider of the mark than the simple rule of thumb.

The result shown is the precise amount of water due on the scale of the general rainfall.

But roof-slates are in summer-time often almost hot enough to burn your fingers, and a good deal of the rain falling on them at such times is, of course, lost by evaporation. In the rough mode of estimate first suggested the error in the calculation and the loss by this evaporative process more or less compensate each other.

An "inch of rainfall" it may be noted, means a little more than 4½ gals. (4·673) per square yard; or roughly, half a gallon per square foot.

Rain-water tanks are constructed more cheaply underground than above, and preserve the water at a more regular temperature; but they are much more liable to unrecognised leakage and to pollution. Above-ground tanks are free from these disadvantages, and are more easily examined.

The best shape is round or polygonal. An excellent material is concrete, consisting of six parts gravel or broken stone to one of Portland cement; but it is not every bricklayer who can mix it.

Every tank should be carefully covered, and a man-hole provided.

Boilers burst: 1, From defective circulation; 2, from water being suddenly turned on into an empty, almost red-hot boiler.

The first may be obviated by the insertion of a small safety-valve, or by a relief-pipe; the second by keeping the boiler always supplied.

A kitchen-boiler is not in any way lessened in value by the addition of a safety-valve.

No wells—not even deep ones—should ever be sunk in the neighbourhood of cesspools, in use or out of use.

In country houses the pump is a very important institution, and not unfrequently draws an appreciable proportion of its all-important supply from the nearest cesspool. Pump-water should always be regarded as under suspicion, and should be thoroughly tested before using.

CHAPTER VII.

DRAINS.

Subsoil drainage—House drainage—Quality of pipes—No square junctions—Pipes too large—Foundation—Jointing—Testing—Pipes under floors—Man-holes—Access to drains—Big bore and little bore—Fall—Disconnection—Traps and cowls—Common sense—Ventilation of soil-pipe — Rain-pipes as ventilators — Awkward outfall — Flushing — Flushing cistern—Waste pipes — Overflow pipes—Absorption of gas—Traps—The big, big D—The death-bell—Closets—Service pipes—Builder and owner—Cleaning drains—Access pipes—Traps and their prey—The Hubble-bubble—An Irish barrier—Unsealing traps—*Verbum sap.*

THE first essential in the way of drainage is to drain the soil on which a house stands. This is called subsoil drainage; and the more thoroughly it can be carried out—in other words, the drier the soil can be made—the better.

Subsoil drainage is carried out on the same principles as regards the site of a house which obtain in the case of a field, and requires an equal amount of skill and experience.

House drainage—or *soil drainage*, as it is sometimes technically but less accurately termed—is

the system of removing fluid nuisances from the house itself

In draining a building the chief points to keep in mind are:

1. That the drain-pipes used are of good quality. The author has sometimes condemned as large a proportion as sixty per cent. of those brought on the site, and this although sent from well-known manufacturers.

2. Lay down straight lines, and let there be no right-angled junctions. When bends are absolutely necessary, always insist upon bent pipes being used, and never allow a curve to be formed by opening the joints of straight pipes.

3. Let the pipes be not larger than is necessary.

4. See that they are laid on a solid foundation, to a regular and sufficient fall.

5. Be careful that, if the pipes are jointed in cement, the cement is not squeezed up so as to leave a hard ridge at the joint.

6. Test the levels thoroughly before the pipes are covered in, and also have the lower end of the drain blocked, and the pipes filled with water, in order to ascertain that the joints are water-tight.

It is impossible too strongly to insist upon the necessity for a thorough inspection of the whole of the pipes after they are laid, and for testing the levels and joints, for it is through the neglect of these precautions, more than in any other way, that drains have so frequently failed to answer their

purpose. Of course it is the architect who must practically see to this.

Very good work may be made with Stanford's joints. With these joints it is only necessary to use a little Russian tallow and resin. The extra price of the pipe is fully compensated by the saving in labour and excellence of the result.

When pipes run under the floors, as they must do in most town houses, iron pipes, coated with a patent preservative solution, invented by Dr. Angus Smith, or treated by Professor Barff's process, have of late years often been used, the joints being made with lead.*

It is a good rule, however, to bear in mind that, wherever it is possible to avoid it, as in detached or semi-detached buildings, no drain at all should run underneath the building.

In every well-planned system of draining, the architect will so arrange that, by means of man-holes, the entire length of the drain and its branches shall be easily accessible, so that in case of need a brush may be passed from end to end without dis-

* The author has used iron pipes, but considers that they have some practical disadvantages, and he thinks that what is still required is a better glazed stoneware pipe with a better joint than is at present in the market. Man's ingenuity will doubtless ere long supply the want. The public are not free from blame for much defective drainage. Too many people only think how *cheaply* they can get their drains laid, instead of how *perfect* they can get materials and workmanship. The manufacturers reply to the demand by the supply of pipes too cheap to be good. The "jerry" or jobbing builder supplies the bad workmanship, and the jerry sanitary engineer looks on approvingly, or doesn't look on at all, but—takes his fee.

turbing the floors of the building or opening up the ground. This will enable the drains to be entirely cased with concrete, thus insuring their preservation from injury.

It is extraordinary that the practice of making drains as large as possible instead of as small as may be necessary for efficient working should have continued so long as it has. The only possible reason must be: "every drain is bound to choke sooner or later, and the larger the pipe the longer it will take before it requires cleaning.

The smaller the pipe the less the friction—*the greater the hydraulic pressure the greater the velocity*, and consequently the less chance there is of any obstruction taking place.

It is a common notion that an ordinary medium-sized dwelling-house requires a nine inch drain; but the idea is altogether erroneous.

To carry off a small quantity of water quickly, a small pipe must be used. The greater the proportion of the wetted perimeter to the volume of water to be discharged, the greater, obviously, the resistance. There are several simple formula for calculating the velocity and discharge of water through pipes, which may be found in all the text-books.

Let us take the case of a moderate-sized house with twelve inmates. Say that they use 40 gallons of water per head per diem, which is a fairly liberal allowance. This gives 480 gallons to pass through the drain in twenty-four hours; at an inclination of 1 in 60 this quantity of water will

pass through a 6-in. pipe in about one minute and a half. At an inclination of 1 in 90 a 9-in. pipe, running full, will discharge in round numbers 980,000 gallons in twenty-four hours, or sufficient to drain a town with a population of over 20,000.

If a pipe becomes choked, it is generally owing to its being too large—not too small—or to faulty laying or construction.

In ordinary dwelling-houses 1 in 30 is none too much to give a drain, or, as the workman better understand it, 4 inches in 10 ft.

Equal in importance to having good pipes properly laid and jointed so as to prevent accumulation and leakage, is the necessity for disconnection and ventilation, with the object of preventing sewer air from passing into the building. There are still comparatively few houses where these essentials to a healthy home exist.

Since public attention has been so much directed to this subject, all sorts of patent traps and cowls and systems, some of them of the most complicated and expensive character, have appeared. And some lamentable failures have resulted. But for the disconnection of drains from the sewer and for their efficient ventilation no patent systems are necessary. The whole thing is best effected by very simple means.

In the first place, a syphon trap should be fixed at the most convenient point between the building and the sewer. In town houses this is generally in the forecourt or area. The water standing in the

trap presents, if pressure be taken off by adequate ventilation, a barrier to the passage of sewer air. And if, by absorption or evaporation, a little should at any time pass the water seal, it is soon diffused in the open air, and does no harm. A good trap for this purpose is Buchan's trap, as shown below.

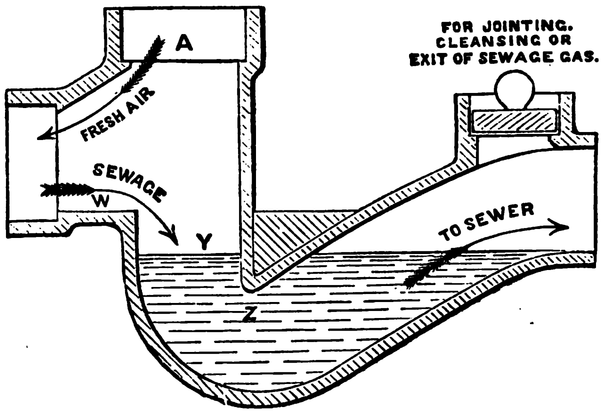

Fig. 3.

Immediately above this trap, that is to say, on the side between the building and the trap, there should be an open drain for a length of 2 ft. to 4 ft., according to circumstances.

For small houses, where the drain is not deep, an open channel, with brick sides widened out at the top, and covered with an open grating, does very well; but where the drain is deep, and, in large buildings, where there are several branch drains, it is better to build a brick man-hole, with open channels at the bottom, through which all the

drainage must pass, and thence through the syphon into the sewer.

This man-hole may have an open grating over it, but, if in a position where there is much traffic, or where dirt or coal-dust is liable to fall down, it is better to have a closed hinged lid—such as Angell's air-tight cover, figured below—and to carry up ventilating flues in the area wall or other convenient place.

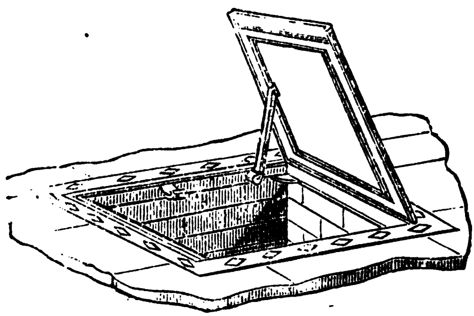

Fig. 4.

Next carry up the soil-pipe well above the roof, not diminishing the size of the pipe, and leave it open at the top or place upon it any good cowl which assists an up-current. Do not use cowls with movable parts, as they are liable to get out of order.

The result of the disconnection and opening of the soil-pipe will be that you will have at all times a current of fresh air passing through the entire length of the drain and soil-pipe.

The soil-pipe should always be carried outside the building.

Remember, on the other hand, that the too common plan of utilising the rain-water pipe as a drain ventilator is a vicious and unsatisfactory arrangement. In most cases the upper ends of these pipes open close to the eaves of the house, perhaps near the cistern, or close to the attic windows; and, moreover, they are often fully employed in carrying off storm-water from the roof at the very time when they are most wanted for ventilating purposes.

It will frequently happen that the level of the outfall will not admit of drains being laid to the fall recommended. In such cases arrangement should be made for flushing at regular intervals.

In schools, or other large establishments, however good the fall may be, a proper and regular flushing of soil-pipes and drains should always be provided. The flushing cistern, fitted with Field's annular syphon (Fig. 5) has lately been introduced, and supplies the want effectually and economically. This is one of those good things which are so extremely simple that we wonder how it is it was not invented years ago.

Waste-pipes should all be disconnected—that is to say, not carried into a drain, or even into a trap, unless there is a free current of air between the end of the waste-pipe and the water in the trap.

Perhaps the most important of all is the overflow

pipe from the cistern, which until recently was invariably, and is still frequently, connected with the drain; or, what is as bad, with the D-trap under the closet. Water absorbs bad gases freely, and this defect has been the cause of much fatal disease. One of the best regulations the water

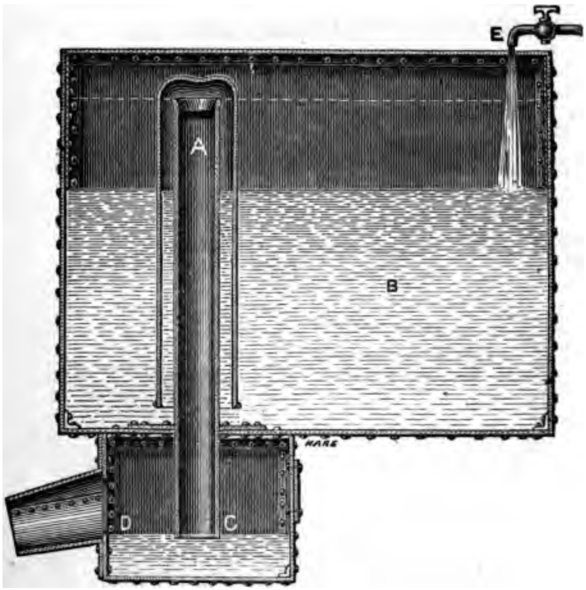

Fig. 5.

companies ever made was that in all new houses the overflow pipes of the cisterns shall be formed as warning-pipes only; in other words, that the water shall shoot out in some conspicuous place, so that it may at once be known that the ball-valve is out of order.

The other wastes that require to be treated in the same manner are: the rain-water pipes, the wastes from sinks, baths, lavatories, and safes—all of which are frequently connected with a D-trap or drain. It seems that D-traps and bell-traps are still much in use. By these two appliances it is probable more illness and mortality has been caused than by all the other usual sanitary defects put together.

Here is an illustration of the "big, big D" trap (Fig. 6), possibly so called to express how D-testable it is.

Here is an illustration of the "bell-trap ' (Fig. 7), or, as it has not inappropriately been called, the "death-bell"-trap.

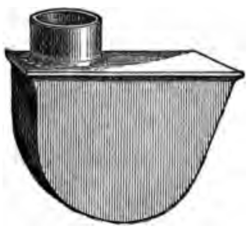

Fig. 6.

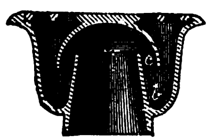

Fig. 7.

The S-traps and P-traps are the simplest and best. One of the best traps to receive the discharge from waste-pipes, and available at the same time for surface drainage, is the cheap gully-trap manufactured by Messrs. Doulton.

Care should always be taken to have the precise kind of trap suitable to the rest of the apparatus. The varieties are too numerous and the details too technical for a work like the present.

In large establishments, where there is much grease discharged down the scullery sink, it is generally advisable to use a grease intercepting tank. A very good form of this useful appliance is Messrs. Dent & Hellyer's grease-trap, illustrated below (Fig. 8).

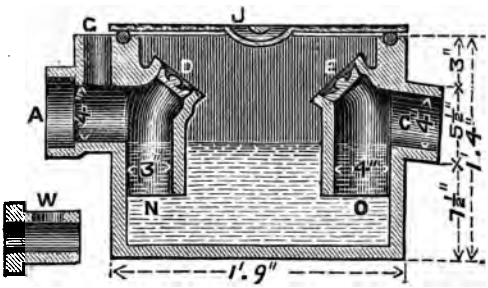

Fig. 8.

Soapsuds are a form of grease very apt to cause a nuisance. A syphon trap should be inserted immediately below the basin, however short the waste pipe, The "flushing-rim lavatory basin" made by Messrs. Tylor & Sons is an admirable contrivance for cleaning the soapy sides of the basin without the assistance of the housemaid.

Of Closets there are, speaking broadly, three classes—the pan-closet, the valve-closet, and the wash-out closet. Unfortunately, although pan-closets have been universally condemned by all practically acquainted with their filth-retaining capabilities, they are still daily manufactured in

large numbers. It is to be hoped the day is not far distant when their use will be contrary to the by-laws of all boards of health and sanitary authorities.

The valve-closet, if properly constructed and trapped, and well supplied with water, although not free from objection, generally gives more satisfaction than any other. But there are valve-closets and valve-closets, and there are traps and traps. F. G. Underhay's is still one of the best valve-closets, and has stood the test of many years. Dent & Hellyer's are also good; and the cast lead anti-D trap (Figs. 9, 10) made by that firm is the best trap that can be used under a valve-closet.

Fig. 9.

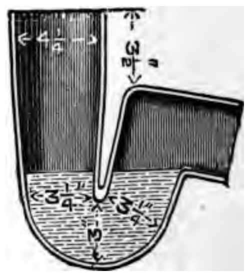

Fig. 10.

The simplest apparatus is the "wash-out closet." Of this kind there are now many forms. Bostel's is good.* Some object to it on the ground that

* Three years ago I had Bostel's closets fitted in one of the London hospitals, where from their mode of construction they met with much adverse criticism, the officials at the outset declaring

from its nature, so small a quantity of water remains in the basin. This is sometimes an objection, but it does not outweigh its other manifold advantages.

Some architects and engineers think well of the plan of having no water-trap below the closet basin, and use what are called trapless closets. And so long as the water-supply and the plunger which closes the outlet from the basin are in perfect working order these closets may be very good. But if by any accident the water be off, the air from the soil-pipe will enter the house through the overflow pipe, and when the plunger is raised. The ordinary valve-closet is also used without a trap under it. This is recommended by some who have given some attention to the subject; but my own experience is decidedly against it. In practice it is found that the advantages of a properly-constructed water-trap under a closet basin outweigh all the objections that can be raised to it.

The waste-pipe from the safe, or lead tray usually placed under the apparatus, should be carried through the wall and left projecting, with simply a hinged copper flap to prevent draughts.

Much trouble often results from a want of care or knowledge in arranging for the service of water to closets. However good the apparatus may be, it is of course essential to obtain a good flush of

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that they would never have another. Some few months since the institution was enlarged, and it was then unanimously decided that this form of closet should alone be supplied to the new building.

water. Specifications frequently stipulate "the service pipes to closets to be ¾-in. pipe," &c., without any regard to the pressure. To get a proper supply, it is necessary to have 1¼-in. pipe and valve where the bottom of the cistern is less than 8 ft. above the closet apparatus, and 1-in. pipe and valve up to 12 ft., and ¾-in. pipe and valve over 12 ft. For wash-out closets the diameter of the pipe in each case should be increased by a ¼-inch.

The regulation of the water companies by which the quantity of water to flush a closet is limited to two gallons has given a great deal of trouble, and is distinctly an unsanitary stipulation. Every flush should be sufficient to carry away the contents of the basin through the drain and into the sewer; and if the closet is situated at any considerable distance from the sewer two gallons of water are insufficient.

For the wash-out or hopper closets there is nothing better than the syphon waste-preventer, of which the following, by Messrs. Purnell, is a good example (Fig. 11). The great advantage of these cisterns is that, if the handle be pulled, the whole of the water in the waste-preventing cistern is syphoned out, whether the handle be held down or not.

In old London houses one constantly finds the closet under the stairs, or in the centre of the house; in a position where light and ventilation are diffi-

cult or impossible to obtain. This is an utterly vile arrangement.

It is desirable to have a ventilated lobby between the main building and the closet; and the suggestion made by Dr. Thompson that the closet should be kept at a higher temperature than the lobby, so that the air may be drawn to the closet

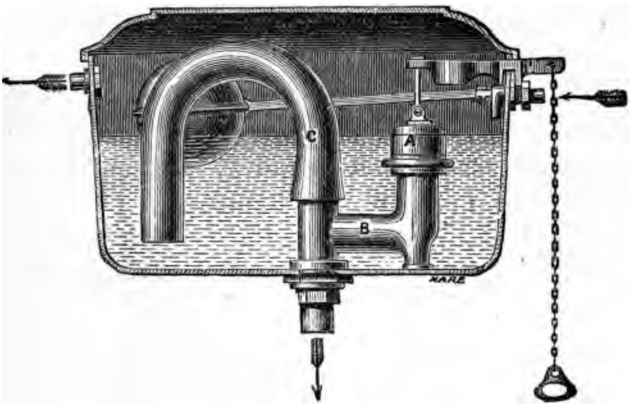

Fig. 11.

instead of from it to the main building, is well worth attention.

Service-pipes are commonly kept carefully out of sight. This is an excellent arrangement—for the plumber, who is thus enabled to conceal any amount of scamped work. For the owner, its drawbacks are three, at least.

1. It makes defects or accidents more difficult of detection.

2. It makes them more mischievous in action.

3. It makes them more costly in correction.

No pipes above ground, as was said in the preceding chapter, should be hidden behind anything but a *hinged* casing.

Drains are cleaned by flexible rods, with brushes attached, and should have, at intervals, openings secured by caps. Pipes so made are called access pipes, and should always be stipulated for where there is no man-hole.

All drain-pipes, traps, &c., should be flushed and cleaned at frequent intervals. A front door-step cannot be kept always clean by simply pouring water over it ; much less a drain.

Traps are—traps. In too many cases nothing more. And the prey they take is the too-confiding householder who puts his trust in them.

For a "working model" of the best form of trap —the syphon—take a look at a "hubble-bubble" (Fig. 12) or hookah, or, if there be not one to take a look at, make one. By the simple process of filling a pickle-jar with water and introducing the pipe-stem and the bowl-stem through two holes in the cork. Then fill, light, and smoke. And, as you smoke, ascertain as closely as you can the difference of suction-power required between that and an ordinary pipe. Because that difference is the measure of the protection afforded by the best kind of trap in the most perfect working trim.

In fact, a trap is exactly like that patent Irish gate which unlocked itself directly it was pushed

at. So long as a stench does not want to come in a trap will keep it out. Mere vagrant nastinesses with no firmness of purpose and no sense of a mission will respect the sanctity of the "water seal," and pass on harmless—as they probably might were there no trap. But the moment there is any pressure, either by suction from the warm house, or by the *vis a tergo* of an over-charged sewer—the moment, that is to say, that protection

Fig. 12.

is wanted—the "water seal" gives way, and the unsavouriness slips quietly through.*

The only way, therefore, to make a trap serviceable is to free it from all pressure; and this *can only be done by ventilating it.*

* This view of the subject does not appear to have presented itself to the mind of Dr. Burdon Sanderson, whose elaborate experimental proof that the pressure of gas in a London sewer is never sufficient to force the water out of a trap is therefore rather "scientific" than practical. No amount of mere steady pressure known to dynamics would be—without the intervention of a gas-tight piston.

It must however be borne in mind that even ventilated traps are liable to become unsealed—

1. Through being "syphoned out" by a sudden rush of water past the mouth of the pipe they guard.
2. By evaporation.
3. By capillary attraction.

Finally—do not take a house in a hurry, as so many people do, and then ask your professional adviser to survey it and tell you why you should not have taken it, or whether you have any claim against the vendor or lessor in consequence of its being in an unsanitary condition. Be wise beforehand, and stipulate that it shall be put into proper sanitary condition to the satisfaction of your adviser. Or, if you are taking a house under circumstances where such a stipulation would not be reasonable, ascertain beforehand what is necessary to be done, and what the probable cost will be.

In other words, "look *before* you leap."

CHAPTER VIII.

VENTILATION AND WARMING.

Connection of subjects—Heated air—Chilled air—Filling a full bottle—The problem of ventilation—Consumption of air—The carbonic acid test—"Hermetically sealed"—In through the wall—Out through the ceiling—Crack ventilation — Requirements — Conditions — Excelsior—CO_2—A right of way case—Compromise—Neither indoors nor out—Chimney ventilation—Back-draught—Central drainage—The open window—Costless ventilation—A refined development—The Floral Art Ventilator—The hole in the wall—Draught deflectors—Tobin's Tubes—Air filters—Cold delivery—Warm air supply—The atmospheric Gulf-stream—Ideal ventilation.

VENTILATION and warming are too commonly regarded as altogether distinct subjects. They are, in point of fact, inseparable. For ventilation depends upon the creation and control of currents of air. And the only way in which currents of air can be either created or controlled, except by the aid of cumbrous and costly mechanical appliances, is by difference of temperature.

Heated air expands and ascends. Chilled air condenses and sinks. This is the fundamental principle of all atmospheric movement. The

question of ventilation is the question of its application.

And with regard to ventilation itself there obtains another popular error. It is commonly considered that in order to ventilate a room you have only to provide it with a supply of fresh air. But this view ignores the simple but important axiom, that two things cannot be in the same place at the same time. You cannot fill a bottle when it is already full; or, at all events, you must begin by providing a means of exit for its present contents *pari passu* with the taking in of the new. If the bottle be full of dirty water, that dirty water must be provided with some means of escape, or you cannot fill the bottle with clean. Just so, if a room be full of foul air, that foul air must have the means provided for it to escape before fresh air can be introduced in its place.

The problem of ventilation therefore is twofold: the extraction of foul air, the supply of fresh. And to these two fundamental principles may be added practically a third. The rate at which this exchange of foul air for fresh must be carried on is determined by the rate at which the fresh air of the room to be ventilated is converted into foul by the various influences to which it is subjected. This is not an absolutely fundamental principle like the others, because there is nothing in the nature of things to prevent the renovation of the atmosphere at ten or twenty or a hundred times the rate thus determined. But fresh air must be

either cold or warmed. And the former is uncomfortable, the latter costly. So that, in practice, the more nearly the actual supply is graduated to meet the actual needs the better.

The first thing to consider, therefore, as indicating the supply that will be needed in any given case is the rate at which air is consumed, or rendered "foul."

And this is the calculated rate per hour:—

	cub. ft.
By each human being	3,000
,, sperm candle	1,500
,, oil lamp	3,000
,, gas burner	20,000

This, at all events, is the recognised estimate, and, so far as the human element is concerned, it is no doubt correct. It may perhaps be a question whether it is quite so accurate in respect of lamps, &c., the basis of the calculation being in some ways not so strictly applicable to the one as to the other. For the deterioration is in every case measured by the amount of carbonic acid added to the atmosphere. And in the case of air which has passed through human lungs this is by no means the only, or even the most important, of the deleterious additions made to it in that passage. The real mischief done to air, by breathing it, is to be found in the organic and other impurities given off by the lungs in very much larger proportion than the one item of carbonic acid. But the proportion of the one to the other is always the same, and as

the carbonic acid is easily detectable and measurable, and the other impurities are not, the amount of carbonic acid is very fairly taken as the representative measure of the whole.

But it does not necessarily follow that precisely the same proportion obtains between the carbonic acid given off by the combustion of a candle or a gas jet, and any other impurities so evolved. So that in measuring these latter by the same carbonic acid standard as the former there would seem to be room for at least possible error.

The rule, however, is no doubt accurate enough for practical purposes, and it is at all events the nearest which scientific experiment has yet given us. So we may adopt it as the basis of our calculations.

On this basis then, a room of 20 ft. long by 15 wide and 10 high, would, if hermetically sealed, contain just enough air to support one man comfortably for an hour. If he had a candle to read by, the time would be reduced to three-quarters of an hour. If he preferred an oil lamp he would only get on for half an hour. If he were greedy of light, and worked by a pair of gas burners, he would reach the end of his atmospheric resources in something less than five minutes!

Now the reader's first comment upon this statement will not improbably be expressed in the simple monosyllable—Bosh! Why! if this were true, he will think, he would have been asphyxiated long ago. But the calculation is quite correct. The

explanation lies in the little phrase, "if hermetically sealed."

No room ever is hermetically sealed, or in any way approaches to that uncomfortable condition. And herein is to be found another most important factor in the great problem of ventilation, very commonly ignored. Not only is a room not hermetically sealed, but, with the exception of the window-panes, there is no single inch of its structure through which, on occasions, air does not make its way.

Here the reader will not improbably repeat his exclamation, with a very distinct conviction that air can't get in through a brick wall. I beg his pardon. Air *can* get in through a brick wall; and in very considerable quantities.

The latest experiments go to show that, with a difference of temperature of only one degree centigrade, there will pass through a square yard of brick wall, 245 litres—7¼ cubic feet—of air; or through one of the larger walls of the room we have been considering, as nearly as may be 4000 litres—118 cubic feet—per hour. This with a difference in temperature of one degree. In a winter's night the difference will rarely be less than twenty.

Plaster however is less permeable than brick, and paper again less permeable than plaster.* And in

* From which may be obtained a striking illustration of this fact of the transmission of air through wall and ceiling. The small percentage of the inhabitants of rooms who observe things will have noticed that when a ceiling grows brown with age the course of the

both the degree of permeability varies very considerably with the quality of the material. In a first-class house therefore, with thick walls, well plastered, and covered with good paper, the amount of air which actually passes through is no doubt but small. But the fact that air can and does pass even through walls should be borne in mind.

The real sources of air-supply however, to an "unventilated" room, are, first, the cracks and crevices of door and window, and even skirting and floor; and, second, should these be insufficient, the chimney. Hence many of the complaints of smoky chimneys, cured at once by the laying of an air-supply pipe under the floor from the outer air to the hearth.

Hence too the miseries of "draughts," and more especially of that most venomous of all draughts, which rushes in under the bottom of the door, and across the whole expanse of floor to the fireplace, in a steady, icy stream, unrecognised save by the unconquerable coldness of the feet, which seem to grow but the colder the more briskly the fire burns.

And finally, be it observed, these uncovenanted supplies of fresh air all make straight for the fireplace, for the simple reason that their only excuse for existence is the filling up a vacancy created by

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joists *above* it is marked by clean lines; and the still smaller percentage who think will have puzzled over, and no doubt in some cases arrived at, the reason. Which is very simple. The blackening of the ceiling has arisen from the coating of smoke and other dirt *strained off* from the air which has passed through it. The solid mass of the joists has barred the way, so the air has there not passed through, and has consequently left no dirt behind it.

the escape of so much other air. And in an unventilated room, the only chance of escape for any air is up the chimney.

An unventilated room therefore is a room in which existence is rendered possible only by draughts of cold air rushing through door and window-crack, straight across the lower part of the room, and thence up the chimney. Cats, dogs, and children "hardly higher than the table," are the only breathers of pure air in a room of this kind.

Its ventilation presents three requirements:—

Deteriorated air to be removed.

Fresh air to be supplied.

Cold draughts to be abolished.

And for the statistics of the problem we have five "laws."

Heated air—and the deteriorated air of a room is necessarily heated—will always rise.*

When one body of air moves away, another body of equal size takes its place.

The new air will not come in until room has thus been made for it.

When it does come, it will come by the easiest available route.

Once started in any given direction, a current of

* Carbonic acid gas (CO_2) is of course, as all the world knows, heavier than common air. But all the world does not always remember that this extra weight ceases to operate in the condition in which it issues, warmed and mixed, from the human lungs. It is a fact which must be borne in mind.

air will continue to follow that direction for a considerable distance, unless forcibly turned aside.

First, then, we have to provide for the escape of a quantity of vitiated air. Let us bear in mind that word "escape."

The vitiated air *wants to get out*, as does the audience in a theatre, when there is an alarm of fire. And, like that audience, it has no sense and no self-control. It goes straight before it, blindly, in the particular direction in which circumstances, external to itself, have launched it. If there be an exit there—good. Out it goes. If there be none—*cadit quæstio.* It stays in. If the exit be guarded by a door which opens inwards, it does not wait to fasten the door back, or pass slowly so as to ensure its remaining open; it rushes on headlong, shuts the door in its own face, and—*cadit quæstio* again.

The direction of the vitiated air is upwards. Its motto is—or would be, if it knew enough of Latin to speak it ungrammatically—Excelsior! Directly it is released, hot and unwholesome, from candle-flame or human lung, it rushes straight away to seek purification along the only way it knows—right upwards. If it find crack or crevice in ceiling or cornice through which it can escape, it escapes thereout, and mingles with the purer atmosphere outside, and is purified and happy. If it find none, its resources are at an end. It has no notion of coming down again and going out by the door. It just stays where it is, pressing against the ceiling,

like a baffled bluebottle blundering buzzily against a window-pane.

"And the moral of this is"—let it out. Make an exit for it somehow, somewhere high up, in the upper part of the wall or in the cornice, or in the ceiling itself.

There still remains, however, the question—Where? And the first answer will be, into the open air. But to this there is the objection that, outside there is the fresh cold air, just as eager to get in and be vitiated as the hot, vitiated air is to get out and be rehabilitated. We may object to this of course as an invasion of the perversity prerogative of the human race. But we can't help it. And the weight of the column of cold air outside is apt to prove more than a match for the mere expansive power of the hot air inside—so that without a little mutual concession there would be a deadlock. The atmosphere, however, if it have no brains, has also no "little tempers." So mutual concession is easy to it, and the result is compromise. The hot air contents itself with creeping out, at greatly diminished speed, through the upper portion of the opening. The cold air takes possession of the remainder, and pours in through it—on to our heads. The compromise is thus effected, on both sides, at our expense. Which may be regarded as an objection to this position of outlet.

Equally objectionable, partly from the same, chiefly from still more obvious, evils is the discharge of the vitiated atmosphere of one room,

through partition wall or ceiling, into another. And it might seem as though, the inside of the house and the outside being alike forbidden, we were here in presence of a difficulty. Happily however there is a middle term—a place of refuge neither inside the house nor out; and moreover provided, as though by design, with precisely the requisites of an effective exit-way.

The natural relief-pipe of a room is the chimney. It is specially built to carry off the products of combustion. And in so doing it becomes the channel of a constant stream of heated air flowing ever upwards with force sufficient to overcome the resistance of the superincumbent atmosphere, and effect its escape.

Drain, therefore, your vitiated air into the chimney, and its progress, instead of being checked, will be aided; while it in turn will contribute to increase, *pro tanto*, the force of the upward stream.

The simplest mode of effecting this is to make an opening direct through the chimney-breast.

It will sometimes happen however that there is a down-draught, and where this is the case the ventilation aperture forms a much too handy means of escape for it without encountering the concentrated resistance of the contracted chimney-throat, with its close contiguity to the fire. This is explanatory of the phenomenon which has puzzled a good many who have tried this plan, and who have been unable to make out why a chimney, which did not "smoke" in the recognised fashion,

should yet constantly send back little puffs of smoke and soot through the ventilator. There is a tide in the affairs of chimneys. But against any ordinary tide the strong up-draught of the narrow chimney throat acts as a sort of Teddington Lock, and brings the tide to a premature termination.

To obviate this back-draught through the escape aperture, Dr. Arnott invented a balanced flap-valve which hangs normally open, to let the heated air escape, but at the approach of a down-current shuts itself in its face.

The drawback to this is that, as there is a constant little struggle going on, with alternation of defeat and victory between the two, the flap-valve keeps up a continual little tap, tap, tap, the effect of which on an irritable nervous system in other than soothing. This difficulty, however, has, in its turn, been overcome in Boyle's Outlet Valves, figured below (Figs. 13, 14), by the substitution for the

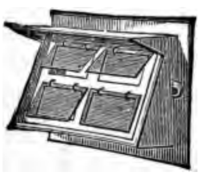

Fig. 13.

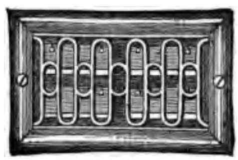

Fig. 14.

iron flap of a number of delicately balanced plates of talc, which " do their spiriting gently," lifting and falling with almost as little noise as the feathers of a bird. An even simpler and perfectly noiseless

appliance is Kite's Dining Room Ventilator, of which the following is an illustration (Figs. 15, 16).

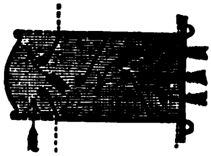

Fig. 15.

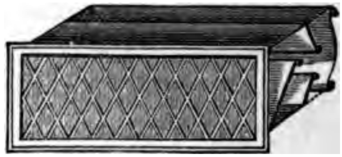

Fig. 16.

There are, however, two drawbacks even to this arrangement. The first, æsthetic. A ventilator in the chimney-breast of sufficient size to act efficiently is an exceedingly difficult subject of treatment from the artistic point of view. The second practical. The fireplace itself already acts as a magnet for all wandering currents of air, doing its best—or worst—to convert them into "draughts." The direct opening in the chimney-breast would exercise its power of attraction to a great extent in the same direction, and so would increase the tendency to "draught" making.

The best of all foul-air escapes is therefore a large aperture in the centre of the ceiling, opening into an air-tight zinc chamber between the ceiling and the floor above, from which a zinc pipe runs straight into the chimney, the opening being guarded by one of the before-mentioned valves. To be ideally complete there should be two or more pipes; the valves at the mouth of each being weighted somewhat differently, thus increasing the escape accommodation in proportion to the increased

pressure from the heated air, as the room fills with company or the lamps are lighted. This refinement however is not necessary in practice.

Sometimes a special air-channel is provided in the chimney distinct from the smoke-flue. And this plan has, no doubt, its advantages. But it is one not always easy of application; and it is not a matter of absolute necessity.

On the whole, therefore, we may consider that, in an existing house, it will probably be most convenient to insert the outlet ventilator in the smoke-flue, but that in a new house the ceiling ventilator should be provided. Not that it is always impracticable to adapt the ceiling ventilator to an existing house, but sometimes practical difficulties in the form of girders, joists, brick-arches under hearths of rooms above, &c., render it very expensive, if not altogether impossible.

The escape question thus settled, comes next that of admission.

And here let us frankly admit that—let enthusiasts say what they will—just as there is no warming appliance equal to a good open fire, so, when circumstances admit, there is no means of airing a room like a good open window. But then circumstances don't always admit of it. And ventilation won't wait for circumstances, but has to be provided regularly—weather or no.

Dr. Hinckes Bird has suggested a simple little expedient for modifying the draught of an open

window, by raising the lower sash and filling up the opening with a piece of board. At first glance this would seem rather an Irish mode of procedure. But it is not so. The result is the opening up of a narrow air channel between the two sashes; and the raised lower sash gives the air which enters this channel an upward direction; so that instead of rushing straight into the room it runs upward towards the ceiling, curving gradually inwards as it loses its impetus.

A more effective and very much more elegant method of producing the same result is to place in front of the lower sash a screen of painted or other glass, raising the sash behind it. By this means two upward currents are produced, one between the sashes as before; the other between the lower sash and the screen. And the collision between the two currents at their turning-point aids in the diffusion of the air which forms them.

But prettiest and most effective of all these modifications of the open window is the "Floral Art Ventilator" of Mrs. Priestley, as shown in the frontispiece. Here the screen of painted glass becomes a glass-case of scented flowers, and the entering current is not only diverted and diffused, but to a considerable extent filtered by its passage through the foliage, and comes in laden with the sweet breath of heliotrope and mignonette.

Passing from these contrivances, we come to the means of air-supply independent of the window.

And, of course, as with the air-exit so with the air-entrance—the first and simplest means of providing a passage is a hole in the wall.

But a hole in the wall is simply a window. When the window has to be shut, the hole in the wall has to be stopped up, and for the same reason. The cold air blows straight in and gives us a cold in the head, or the rheumatics, or some equally efficient substitute.

The next step, therefore, is to prevent the cold air from blowing straight in. Not, be it observed, from blowing in, because that is simply "giving it up;" but from blowing in—straight. And to achieve this end, numerous—one might say innumerable—contrivances have been perpetrated.

The hole has been covered with perforated zinc, or fine wire-net, or other dispersers of a similar kind, converting the one perpetual stream of cold air into an indefinite number of smaller and weaker streams. Louvres, or slanting laths like those of a "jalousie" shutter, have been inserted with a view of giving the current an upward turn. Conical openings have been tried with various modifications of detail. And most effective of all are what are known as Tobin's tubes; which, drawing in the air at their lower extremity from the aperture in the wall, carry it straight up the inner side of the wall some five or six feet, and then, having thus far brought it up in the way in which it should go, leave it to pursue its way ceiling-wards in accordance with that fifth law of "impetus" mentioned some pages back.

All these arrangements may, under certain conditions and in appropriate situations, be used and useful; the most generally available of them all being undoubtedly the so-called Tobin's tube. They are so often valuable that it is as well to give a hint or two as to the means of modifying their defects, the chief of which is that the outer air from which they draw their supplies is itself very far from being of unimpeachable purity; being often heavily loaded wth dust, blacks, &c.

One plan for filtering the intake of air is the placing in the entrance aperture an open box filled with cotton wool. This however, though it filters the air, almost entirely destroys the current; so that not only is the supply checked, but the main action of the tube itself is done away with.

Another plan is to make the entering air pass in a thin stream over the surface of a pan of water. This also is effective, while it lasts. But it is liable to the drawback that the water very quickly evaporates—and is quite certain not to be more than semi-occasionally replaced.

The best plan of all is to place in the tube itself a strainer of coarse muslin stretching diagonally from top to bottom across the whole width of the tube, or suspended in the form of a common jelly-bag. This gives the maximum of filtering surface, and consequently the minimum of obstruction to the current; and the screen can easily be taken out and cleaned—should any one happen to think of it. Of

course, where the outer air is pure, filtration is superfluous.

But the main objection to the tubes, as to all the other systems of the kind, is that they deliver their air cold. They may modify to some extent the plain Arctic gale of an open—or the still crueller knife-edge draught of an ill-closed—window. But the very best they can do is to fling the Arctic stream up against the ceiling, from which it drops down again in an Antarctic douche, bringing with it a fair share of the impurities of that top stratum of impure air in which it has performed its somersault.

What we want is a supply not of cold but of warm fresh air; and no system of ventilation approaches perfection which does not give it. And here again the chimney comes to our aid—the lower portion of it this time, just as the upper portion was utilised in our previous undertaking.

Convert the whole space at the back and side of the fireplace into a warming chamber.

Into this chamber conduct the cold air from without, filtered in what way you will. The suction power of the heated chamber, joined to the weight of the column of cold air outside, will overcome a considerable amount of obstruction in this way, and render the process of straining easy.

Then, from the upper portion of the chamber, provide a convenient means of passage for the warmed air into the house, and the arrangement is complete. The precise locality and nature of the passage-way to be provided must depend on many

varying points of construction and arrangement, and can probably only be solved in each case by a skilled opinion. But *the lower down the better.*

Wherein I am venturing to differ very directly from Captain Douglas Galton.

Captain Galton points out, quite truly, that the way in which a fireplace acts to create circulation is—"The air is drawn along the floor towards the grate. It is then warmed by the heat which pervades all objects near the fire, and part is carried up the chimney with the smoke, whilst the remainder, partly in consequence of the warmth it has acquired from the fire and partly owing to the impetus created in its movement towards the fire,* flows upwards towards the ceiling near the chimney-breast. It passes along the ceiling and, as it cools in its progress towards the opposite wall, descends to the floor, to be again drawn towards the fireplace."

From this very accurate description of what may

* Here, too, I venture to differ from Captain Galton. It is only when the direction of a current is changed *by the intervention of some obstacle* that the impetus acquired in the old direction is transferred to the new. The ascensive impulse communicated by heat interposes no such obstacle. The vapour, for instance, drawn up by the sun from the surface of a stream does not rise either the higher or the more rapidly for the swiftness of the stream from which it is drawn. No doubt but such portion of the current as—after being withdrawn by new ascensive impulse from the suction range of the fire—preserves sufficient impetus to project it against the chimney-breast, will have what *then* remains of that impetus directed upwards. But that will probably not be a large proportion; especially as the fire-draught will act to a certain extent as a drag directly the diverted current begins, so to speak, to turn its back upon it.

be called the atmospheric "Gulf-stream" of a room with an open fire and no ceiling ventilator, Captain Galton draws the conclusion that the best position in which to deliver the warmed fresh air is between the chimney-piece and the top of the room, "for the air thus falls into the warmer upward current and mixes with the air of the room without disturbance." As no doubt it does. But then, of two things one. Either the room is ventilated at the ceiling—in which case the fresh air walks straight out again almost as fresh as it came in—or else it is not so ventilated. In which case the fresh air mixes, not with the air that is to be breathed, but with the air which has been breathed, and which it brings back with it, diluted certainly, but dirty still, for reinspiration.

The ideal place for delivery of the fresh, warmed air would be through the skirting of the wall farthest from the fire, or, better still, perhaps, through the floor just inside the door. The actual best place must depend, as I have said, on practical considerations. In point of fact the great object of ventilation is to break up the Gulf-stream arrangement altogether, and so arrange both extraction and supply as that air once breathed should have no chance of returning, but be sent straight about its business—which for the present is purification.

The only point remaining to be considered—and it is an important point—is the amount of air to be supplied and extracted, and the size of the respective exits and entrances.

Every human being, as we have seen, requires an hourly supply of 3000 cubic feet of air. The aperture to admit this quantity should be six inches by four; for two people, of course, six inches by eight; for two people and a lamp, or a pair of candles, half a square foot, and so on; every additional 1000 feet requiring a further opening of eight square inches, or, say, two inches by four.

Where gas is used the best plan is to have a separate supply of fresh air expressly for it. There is a very excellent lamp of this description—for an illustration of which see chap. x.—which draws its own air-supply from the outer air, and delivers the products of its own combustion to the chimney. Or, if this proved too expensive, a Tobin tube, placed as near as possible to the gasalier, might be made use of for this purpose.

CHAPTER IX.

WARMING AND VENTILATION.

A distinction with a difference—Radiant heat—Snow mountains—The open fire—The close stove—Count Rumford—The splayed grate—Fire clay—Economy *versus* æsthetics—Tiles—The register—Smoky chimneys—Cowls—Underfeeding—Stove-heating—Gas stoves—And their cost—Hall and staircase—An air-warmer.

IT may seem as though in these two chapters there were a certain amount of sameness. But it is not so. The subjects of them are quite distinct; the only reason for connecting them being—that they cannot be treated separately. So, as in the preceding chapter I dealt with ventilation as it is affected—and effected—by warming, so in the present chapter I propose to treat of warming with view (*inter alia*) to its bearing on ventilation.

The preceding chapter was almost exclusively theoretical, the appliances of ventilation being simple, and their judgmatic application rather difficult.

The present chapter will be almost as exclusively practical. The varieties of the stove, grate, and hot-pipe tribe are legion; the philosophy of the thing simple enough. In fact, the one theoretical

point to be mastered is the difference—for it is much more than a distinction—between "radiant" and other heat.

Radiant heat is the direct heat from an open fire, or from that biggest of all fires with which we are practically acquainted, the sun; and it has this peculiarity, it passes clean through the air without warming it. Any one—if any such there be—whose memory goes back so far as the last real sunny day,* will be inclined to think this a delusion. But it is not so. The sun, when there is any, warms *them*, as it warms the ground and the trees and the houses, and every other solid object on which its rays fall. And the heat which they, thus warmed, give off warms the air. Which is why the points of the earth's surface which are nearest to the sun are the longest covered with snow—not because they are nearer to the sun, but because they are farthest from the things which convert the sun's rays into practical warmth.

This is also the reason why, for once at all events, John Bull is right, and his favourite open fire the best and most "scientific" of warming appliances. Because the air is not made oppressive by heating, and the floor and ceiling and walls and furniture, being all warmed by the direct rays of the fire, have no need to indemnify themselves for being left out in the cold by abstracting warmth from him.

* It will be borne in mind that this is written in England, in the spring—so-called—of the year 1883.

A close stove, on the other hand, gives out heat which warms the air and that only; and in consequence the air becomes hot and oppressive; and the walls and furniture, being cold, have no scruple in supplying themselves with warmth extracted from the unfortunate inhabitant of the room.

This point of difference between the two kinds of heat once fairly grasped, and the theoretical part of the business of warming is mastered.

Practically: in living rooms there is nothing like an open fire.

And as the advantage of the open fire consists in radiation, the more perfect that radiation the better. And radiation is very much a matter of form—the form of the grate in which the fire is contained. The old-fashioned square grates were probably not expressly devised to secure the extraction of the minimum of warmth from the maximum of coal. But, if they had been so designed, they would have afforded a really remarkable example of the perfect adaptation of means to end.*

Count Rumford was the first to call attention to

* Some of our stricter æsthetes are reintroducing this form of grate as in better keeping with the general Queen-Anne-ity of their ideas. In rooms so treated, it is well to bear in mind that the entire grate will have to be on a larger scale. The square grate should be on a scale to burn about double the amount of coal required for the modern grate—rather more than less. If the "hob" and the open chimney be also adopted, as of course should consistently be the case, the size of the grate should be doubled again to allow for the additional loss of heat up the chimney. This gives a fine expanse of fire, without any fear of overheating the apartment.

the extravagance of this form of grate. The final result of his teaching has been the "splayed" grate, with the narrow back, sloping sides, and bowed front; and the covered top, with its contracted chimney-throat, capable of still further contraction by the partial closure of the "register" door.

The back of this grate commonly is, the sides should be, formed of "fire-clay," which is itself a powerful absorbent and radiator of heat.

The curvilinear outline of this modern grate does not lend itself as readily as the square Queen Anne construction to tile-decoration. But wherever tiles can be used about a grate they are not only a pleasant ornament but an useful heat reflector.

How ornately grates of this form can be treated, is well shown by the following drawing of one of Doulton's glazed-ware fireplaces (Fig. 17).

As observed in the preceding chapter, the warming power of a grate is largely increased by the utilisation of waste heat.

A simple method of diminishing the loss of heat up the chimney is the partial lowering of the "register." With an ordinary register this is a result only to be achieved by much manœuvring with combined poker and tongs, and a considerable amount of subtle contrivance in the propping up of the refractory door.

A more scientific mode of utilising waste heat is that of the air-warming chamber already referred to.

Smoky chimneys hardly form a legitimate branch of the science of warming. But they are sufficiently frequent accidents of its practical application to claim a word.

The ordinary smoky chimney is the mere creature of insufficient air-supply. Lay on an air-pipe from outside the house to the hearth, and nine times out

Fig. 17.

of ten your chimney will be cured. Sometimes, however, its smokiness arises from awkwardness of situation. The chimneys of a small house, for instance, may be domineered over by a loftier neighbour, from whose roof the wind, when in certain quarters, may pour straight down them. This is a more difficult problem. Soluble, of course, by carrying the afflicted chimney to the requisite

height. But this is not always practicable; or, to speak more exactly, not always safe.

The only other plan is a cowl. Of these there are, say, half-a-dozen, more or less, adapted to each particular combination of adverse circumstances. And the number of combinations of adverse circumstances are infinite.

So far we have only dealt with the ordinary open fire fed by coal thrown on at the top. And this is the best, brightest, and pleasantest form of heat-producer. But it is not—even in its modern greatly improved form—the most economical.

A means of extracting more heat out of less coal, while still preserving the main characteristic of the open grate—radiation—will be found in the system, first introduced by Dr. Arnott, of feeding the fire from below.

The fire thus produced is not so cheerful as that fed at the top. There is no "jolly blaze." But it gives a good supply of radiant heat, burns its coal thoroughly and slowly, and therefore burns in proportion less of it.

A good example of this principle may be found in Edwards's smoke-consuming slow combustion grate, a section of which is shown opposite.

In this grate a supply of coal is placed in the fire-basket or chamber, the fire being lighted in the ordinary way on the top of it. So far it is a simple adaptation of Dr. Arnott's principle; the modification consists in a sliding screen in front of the fire,

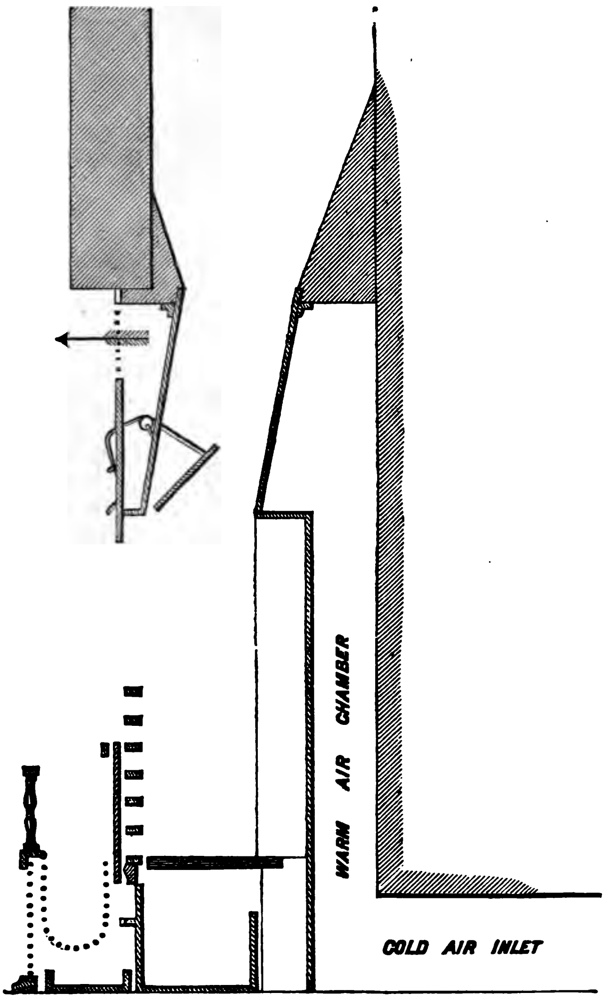

Fig. 18.

which is lowered as consumption of coal proceeds, thus doing away with the cumbrous appliances for lifting the coal.

Stove-heating is more economical still, but, as already said, it is less cheerful and less wholesome.

Of course the latter disadvantage may be got over by careful ventilation.*

But nothing can ever place it—in our climate, at all events—on anything like the same level for living-room use with the open fire. For halls and so forth, however, the stove is a very useful appliance.

Fig. 19.

Much has been done in improving the personal appearance of these hitherto ill-favoured appliances by Messrs. Doulton & Co., whose radiating stoves figured above (Fig. 19) are really ornaments.

* Indeed, for really "scientific" work in this way the stove affords more scope at less cost of ingenuity than the open grate. But the scientific beauty of a process is not always in direct proportion to the practical comfort of the result.

And so we come to the question of warming by gas. This is in many ways exceedingly convenient. And, in all, enormously expensive.

An open gas-fire to burn—as some do—with really almost the cheerful blaze of a good coal-fire, will cost three or four times as much. Its convenience, however, or, to speak more exactly, its luxury, is great.

It gives no trouble, makes no dirt, can be lighted, raised, lowered, or put out by the simple turning of a screw, and, if so desired—as, for instance, in chambers—can be left burning on Saturday night, with full assurance of being found burning still on Monday morning.

There are also various contrivances for heating by gas without any pretence of looking like a fire; and these are somewhat less extravagant, though still costly enough.

Neither the warming nor the ventilation of a house, however, can be considered complete unless due attention have been paid to hall and staircase. There is no such preventive of cold draught as a warm staircase. Even as a matter of mere economy, the saving in coal for drawing-room, dining-room, and other fires, will very nearly, if not quite, recoup the cost of staircase-warming.

Boyle's Patent Air Warmer is a simple means of warming the fresh-air supply where hot air, water, or steam pipes are not available. It consists

of a copper or iron pipe, about one and a half inches diameter, placed within an inlet tube, preferably of the form of a bracket. This pipe zigzags across the tube from top to bottom, causing the incoming air to repeatedly impinge upon it in its passage. At the bottom of the apparatus is a chamber, in which is placed a "Bunsen" burner, the flame of which plays up into one end of the pipe; the heat travels through the entire length of the pipe, the other end of which may either dip into a condensation box in the bottom of the tube or be continued into a flue or extraction shaft. If the pipe terminates in the box, the vapour is condensed there and carried off through the outside wall. A loose bed of charcoal covering the bottom of the box is intended for the purpose of absorbing and rendering innocuous the products of combustion. The charcoal should be renewed about once a fortnight or month, according to the extent the tube is used. In the diagram opposite, A is an inlet tube or bracket, of galvanised iron and painted; dimensions, 24 in. × 16 in. × 6 in. (Fig. 20). These tubes can be treated ornamentally, to harmonise with the decorations of the room. The top of the tube should stand about 5 ft. 9 in. from the floor. B, copper or iron tube, 1½ in. diameter. C, chamber containing the burner. D, Bunsen burner. E, opening covered with perforated zinc inside of tube communicating with chamber, for the purpose of supplying air to the burner. F, small hole fitted with sliding shutter through which the gas is

lighted. G, condensation box. H, opening in bottom of box to allow of the circulation being maintained in the heating pipe. J, pipe for carrying off condensed vapour. K, continuation of pipe into flue or extraction shaft.

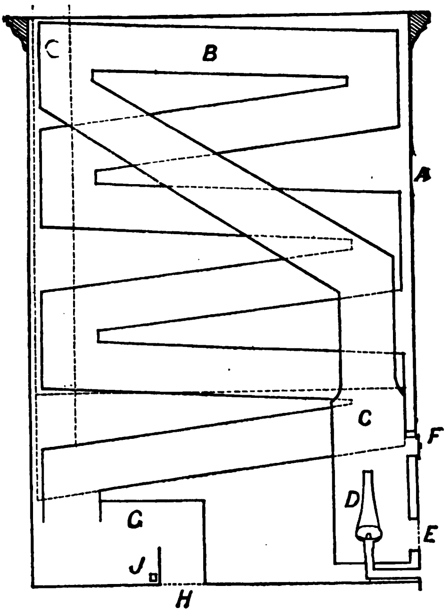

Fig. 20.

Where the tubes are placed against woodwork, all chance of fire may be avoided by fitting them with a double casing or jacket, and filling in the space between with asbestos or other nonconducting material. With this arrangement the air supply

can be raised from a temperature of 30° to that of 130° at a very small cost.

Experiments at the Reform Club seem to suggest that this apparatus might very possibly be used as the sole means of heating rooms.

The tubes are fitted with regulating valves and deflecting shields, to prevent the air from discolouring the walls. They can also be fitted with an arrangement for cooling, filtering, and freeing the incoming air from blacks and dust.

CHAPTER X.

LIGHT.

Light and life—Dark rooms—Daylight reflectors—Vaults and cellars—A translucent staircase—Candle, lamp, or gas?—Ventilating globe-lights — Sun-burner — Fish-tail, bat-wing, and flat flame—Argand—Imperfect combustion—The Silber Argand—The battle of the burners—Variation of pressure—Dangerous precautions—Sliding tubes—Table lamps—General gas supply—Service pipes—Taking possession—Stoppages—Meters—Testing meters—Gas-pipes—Governor—Electric light.

THE importance of light to health is more recognised than it used to be.

Of course, if you have sensitive eyes, or a constitutional preference—as many people, especially brain-workers, have—for the soothing influence of darkness, then the question becomes one of compromise, to be settled fadwise. If not, there is, so far as daylight is concerned, only one rule—a very simple one. Get as much as you can.

Sometimes in towns, or in very large and not very cleverly planned buildings, there are windows into which only a defective supply of light can be directly introduced. An excellent plan in such a

case is to place the window flush, not with the inner but the outer side of the wall, and to glaze it with roughly ground or fluted glass, which transmits more light—paradoxical as it may seem—than the transparent.

One or other of the various forms of "daylight reflectors" will also be found useful.

In London, too, and other large towns, it is often necessary to utilise, for various purposes, vaults and cellarage of various kinds under a footway. These may be very fairly lighted by means of Hayward's Pavement Lights. These Lights may also be used in staircases. In which case, it is perhaps hardly necessary to point out, the staircase carpet is a redundancy.

In the way of artificial light, the question lies between candle, lamp, and gas.

The best, pleasantest, softest, and very much most costly light is that of wax candles.

The most abundant, cheapest, and—light for light—coolest illuminating agent is gas. It is commonly supposed to give out more heat than any other. But this, like most popular ideas, is a delusion. Those who burn gas get their rooms more heated than those who burn candles, but that is because they get twenty times more light, and, in fact, must have it; because gas cannot be wholesomely burned at a very low pressure.

The ventilating gas globes, however, referred to in chap. viii. (p. 94), give comparatively but little

heat, and *do not foul the air at all.* The following illustrations show these burners in section and pictorially.

Fig. 21.

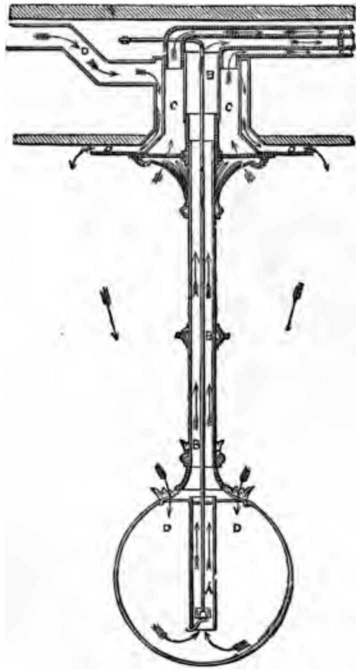

Fig. 22.

Another excellent mode ot using gas in halls and other large rooms is the sun burner. A screen of thick glass underneath one of these keeps off the greater part of the heat, most of which moreover passes in any case up the ventilator.

With the ordinary gas-lamp for use in houses of

moderate size the great question is that of the kind of burner employed.

Gas-burners for domestic use may be divided into four kinds—the fish-tail, the bat-wing, the flat flame, and the Argand.

The fish-tail burner delivers its gas through two tiny holes pierced in a small cup. With gas of high illuminating power this burner gives excellent results; with gas of such quality as is now supplied in London it can hardly be recommended. It is useful in situations exposed to draught, such as basement passages, as it gives off less smoke under these unfavourable conditions than burners of different construction.

The bat-wing burner delivers its gas through a fine slit cut in the top of a round knob. The light of this burner is distinguished by its long, low flame, representing the shape of a bat's wing, after which it is named. This burner is now seldom used in private dwellings.

The "flat flame" burner, while retaining the slit of the bat-wing in a slightly altered form, retains also the shape of "fish-tail" flame in a very much improved form. This burner, when surrounded with a "Christiania" globe, as shown opposite (Fig. 23), and supplied with gas at a proper pressure, is, perhaps, one of the most satisfactory burners that can be employed.

The Argand delivers its gas through a series of fine holes pierced in the top of a ring. The flame of this is cylindrical, and requires a chimney-glass.

It gives much more light than either of the others, and burns much more steadily, but consumes more gas.

The great point to be arrived at in a burner of any description is the successful proportioning of air and gas.

If the air supply be insufficient, combustion is imperfect through lack of oxygen. If the air

Fig. 23.

supply be in excess, combustion is imperfect through loss of heat.

The furnishing of exactly the right quantity of gas, at exactly the right pressure, and sustained by precisely the right proportion of air supplied in precisely the right manner, constitutes the gas-

burner's claim to such modified immortality of honour as mortal gas-burners may enjoy.

The Silber-Argand shown below combines (Fig. 24) these advantages in a very high degree.

Fig. 24.

This burner is constructed of brass and steatite, and is supplied with air in two concentric currents having access to the inner, and two others having access to the outer surface of the flame.

The gas passes first into a chamber of brass, and thence upwards into one of steatite, the top of which

is pierced with twenty-four holes, through which the gas passes to supply the flame. A special vertical tube directs a part of the air-supply to the upper portion of the flame, and the distribution of air thus effected greatly assists combustion and enhances the supply of light.

Fig. 25.

The London Argand, illustrated in the above cut, with its improved form of governor, is perhaps the best at present obtainable. It is made in a great variety of sizes, and is especially suited for reading lamps and for the shade lights, now so generally used in dining-rooms.

The Silber bat-wing is a combination of two ordinary bat-wing burners, one inside the other. The aperture of the inner is rather smaller than that of its outside neighbour, so that the gas is checked in its passage, and arrives from the latter at a lower pressure.

The Sugg bat-wing, on the other hand, boasts an ingenious modification in the form of the slit itself, which is so cut as to give an upward curve to the outer edges of the flame, thus improving its form. Mr. Sugg has also introduced into it what he terms a "table-top," of steatite, a small plate which still further improves the form and luminosity of the flame.

For gas of not more than twenty candle-power, the "Manchester" double bat-wing is a good burner, the light given being greatly in excess of that afforded by two single burners.

And there is also an American bat-wing, of very elongated form and narrow slit, and surrounded by a brass tube. The pressure is here taken off by the passing of the gas, in the first instance, through the chamber formed by the space between the burner and its brass casing. But this, however, does not accommodate itself to our English fittings, and is only used for the "air-gas" made of late years in some private establishments for home use.

Next comes Mr. Silber again, with the modification of the union or fish-tail, to which he has given the poetic title of the "Concordia," and which is shown opposite (Fig. 26). Allegorically disposed

minds may find, in examining this burner, a certain pleasant suggestiveness in the fact that the complete harmony of the result is here obtained by the introduction of a little piece of brass, which keeps the two jets that produce it a little apart. The Concordia is said to give an illumination very nearly equal to that of an Argand.

Fig. 26.

This excellent burner has lately been still further improved by the introduction of an ingenious valve, which, whena serious reduction of light is desired, enables one jet to be turned off entirely, leaving the other burning.

Mr. Silber's "Perfector" is another ingenious little artifice for the obtaining by partial separation a more effective harmony of action, the dividing piece being in this case formed of zinc. The principle of this and of the Concordia burner is practically the same.

This of course does not profess to be anything resembling an exhaustive catalogue even of appliances such as might fairly be classed among "the best." And the battle of the burners is being waged so briskly that, between the printing of one side of a sheet and that of another, something like a revolution may not inconceivably be effected. All

that can be attempted here is a "hint" or two suggestive of principles.

The king of burners—under the present *régime*—has still to be mentioned; but it is too kingly for ordinary use in dining- or drawing-rooms of everyday life.

This "Regenerative" burner is the invention of Mr. Siemens, and consists of a most ingenious application of the heat of the flame to the warming not only of the air by which the combustion is supported, but of the gas itself by which it is fed. Roughly it may be described as a large Argand burner, the upper part of whose flame, instead of towering straight upwards in the ordinary fashion, is turned over, and, as it were, tucked down into the centre of the burner, much after the fashion in which the wrapping paper is sometimes tucked into the ends of a roll of music.

The burner is thus entirely enveloped in flame, ascending around the outer and descending around the inner surface; and an ingenious arrangement of tubes and chambers utilises the heat for the warming of both gas and air.

The drawback for domestic use is, as has been already said, that it is only effective on a comparatively large scale, the smallest amount of gas it will condescend to burn being ten feet per hour, for which it gives the light of fifty candles.

Great things are expected from the modification of this plan, by Mr. Grimston, who looks

forward to the production of a lamp which, on much the same principle, shall give equally good results—in proportion of course to the amount of gas burned—in the smaller sizes as in the large.

A difficulty in gas-burning is found in the variation of pressure at different hours of the day, particularly in districts infested by shops, theatres, music-halls, and public-houses. These variations are both great and sudden; and if the gas be not instantly turned down when a rise of pressure takes place, there is an immediate shower of soot.

To meet this difficulty a "governor" has been invented, the use of which is strongly to be recommended.

Some too careful people have a way of turning off the gas every night at the main. This is a very insane practice. The result is twofold:—

1st. If light be wanted in a hurry at night it is only to be had by trundling down to the basement and turning the gas on again—an achievement, for which probably only one or two persons in the house will possess the needful topographical knowledge.

2nd. The turning off at the main at once extinguishes every burner in the house, whether its particular tap be shut off or not. Sooner or later —probably sooner—one or more of these taps will be left unturned. Then, when the main-supply is

turned on again, comes a grand "escape"—and possibly also a "narrow" one; the latter being dependent upon the happily inevitable stench attracting practical attention before gas enough has been let loose to ensure the probable explosion.

Another fruitful source of difficulty with gas is the drying-up of the water in the sliding tubes of gasaliers constructed, as almost all centre gasaliers are, to be raised or lowered as required. This water evaporates but slowly—but it does evaporate; and when it is gone the gas escapes. It is a good plan not to wait for this, but to have the supply renewed at regular intervals—say every quarter-day. It is a still better plan to fill up only partially with water, and complete the charge with a spoonful or two of oil. This floats on the top, and keeps the water from evaporating, so that, thus protected, it will be safe for an indefinite period. Pure glycerine forms an excellent joint, and does not evaporate.

If you have table lamps supplied by flexible tubing, never make any use of the stop-cock at the lamp itself, but always effect any desired change by means of that at the standing-pipe. The elastic tubing may not actually leak under pressure, but it soon becomes saturated with gas, and smells unpleasantly. The patent American flexible tubing only should be used. While much more expensive than that of English make, it remains perfectly free from smell, and is very durable.

The general supply of gas is of course differently regulated in different places. This may be safely

predicated of anything English. A comprehensive view of the subject is quite beyond the capacity of our space. We must confine ourselves to the metropolis.

London then is supplied with gas by three companies. The Gas Light and Coke Chartered Company, whose chief office is at Horseferry Road, S.W. The London, with offices at 26 Southampton Street, Strand, W.C. The South Metropolitan, whose offices and works are at 587 Old Kent Road, S.E.

The gas supplied by each of these companies is almost identical in quality. It has often been asserted that one supply is worse than the others. But no one has ever yet succeeded in making out which it is.

The price varies from about 2*s.* 10*d.* to 3*s.* 2*d.* per 1000 cubic feet. The dividend remains pretty stationary at the legal *maximum.*

The service pipe which conveys the gas from the company's main in the street to the consumer's premises is the property of the gas company, and is always maintained in order by them, and at their expense.

If, when taking possession of a house, it be desired to make use of the gas, or if at any time any alteration in size of service pipe be required, application must be made to the company's office.

On having the gas laid on for the first time, or on entering a new house, it is usual for the

consumer to sign a form of contract by which he engages to pay for all gas consumed on the premises, and to allow the company's servants free access to the gas meter at all reasonable hours.

An incoming tenant cannot be made liable for any money due to the gas company for gas supplied to the outgoing tenant.

Whenever any stoppage occurs in the service-pipe, the gas company, on being applied to, will naturally remove this free of charge.

The gas meter should be fixed in a dry, cool place. Wet meters are more correct than dry meters, but the latter are generally preferred, because they give less trouble in use.

It is generally considered better to rent a meter from the company, who will be responsible for its proper working. Where, however, large meters of 100-light and upwards are used, it is cheaper to purchase.

It is not necessary to have a 10-light meter for 10 fish-tail or flat-flame burners. When a 10-light meter is spoken of, a meter of sufficient capacity to supply gas to 10 Argand burners, each consuming, say, 6 cubic feet per hour, is intended.

A 10-light meter will supply from 12 to 17 fish-tail burners. For larger sizes corresponding allowances must be made. In the event of a meter failing to register correctly, or its correctness being suspected, provision has been made, under the

"Sale of Gas Acts," by which a consumer can send his meter to the office of the Metropolitan Board of Works, where for a small charge it will be tested by officials independent of the gas company.

The office of the western division will be found in St. Anne Street, Westminster, S.W.

The charge for testing meters is as follows:—

1 to 5 lights	6*d.* each.
10 to 40 lights ..	1*s.* each.
50 to 60 lights ..	2*s.* each.
60 to 100 lights ..	3*s.* each.

and so on.

If the meter register against the consumer, the gas company pays the fee, provided the meter be a rented one. Should the meter prove correct, the consumer pays.

All gas-pipes laid throughout a house should be of wrought iron or copper. No pipe less than ½-in. internal bore should be used under the floors or buried in the walls; on the face of woodwork in dwelling and bedrooms ½-in. copper pipe should be used.

With London gas, pipes of ample bore are everywhere necessary, and the pressure of gas should be regulated near the meter by a well constructed wet governor. To prevent the water freezing in winter, or evaporating in summer, 25 per cent. of *pure* glycerine should be mixed with it. There are innumerable "gas regulators"—there

are none however to compare in certainty of action with the wet governor.

A gas-pressure gauge should be attached to the governor to show that it is working properly. Fixing a governor of any kind, without any means of ascertaining that it is doing its duty, is carrying faith to the limits of weakness.

To the above conditions add gas-burners of the best description, and it will be found that, with London gas, an amount of light, an absence of heat, a freedom from smoke and dirt, will be obtained, together with an amount of safety and convenience with which no other illuminating agent can at present compete.

The electric light hardly enters into question, though in a very large house it might be worth a trial. Its great drawback is that it requires a steam-engine—or at the least a gas-engine—to keep it going, and that the light is, to most people, rather trying to the eyes, and a little chilly to the inner man. But it is the only pure artificial light, and for those who have delicate colour-work to do it is a real boon.

CHAPTER XI.

DUST.

The Householdress—The place for dust—Removal—Cremating cabbage-leaves—The dust sack—The iron dust-bin — Disinfectants — Tickling the dome — Two smells for one—War "to the broom" — Dust preserves — Marqueterie.

WE leave now for a time the domain of the householder and househunter, and come to that of the househuntress and householdress. Who will do well to give a personal eye to those matters of domestic detail with which the masculine mind is so prompt in recognising its inability to cope.

And from the point of view of our present topic, the most important of these domestic details is the disposal of what may be classed under the general head of "Dust."

Dust, like all other dirt, is accurately enough defined as "matter in the wrong place." The terms are not convertible, of course. There are things—as there are people—in places inappropriate enough, but solely in the way of not being good enough for their occupants. But dust is certainly matter in the wrong place in the most proverbial sense.

And the wrong place for it is—anywhere on the premises.

The sooner dust, and all that is akin to it, is removed, the better. If in the country, to await whatever manurial consummation may be assigned to it, at some safe distance from the house. If in town, then to the contractor's keeping.

In the former case it should not remain on the home premises for a single day. In the latter some latitude must be allowed. Dust contractors, though keen enough in insisting that no one else shall interfere with their grimy prerogative, are not absolutely enthusiastic in the collecting of their perquisite for themselves.

When however the delay is too protracted, a letter to the vestry clerk will commonly put an end to it. Failing that, the only resource is the police magistrate.

Another point to remember is, that no dustbin should ever be within the house, so long as there is a possible corner for it outside. And no animal or vegetable refuse should ever be put into one. All such should be dried up at night at the kitchen fire, and burned in it in the morning.

There is a superstition in the minds of some worthy people, living in houses rather larger than they have been accustomed to, that this is "all very well in a small establishment, but impossible in a large one." This is pure delusion. People don't eat more vegetables in a large house than a small one. There are more people, of course. But there

is also proportionally—or rather, in all likelihood, disproportionally—more kitchen fire.

An excellent plan—incomparably superior to the ordinary one of digging out the contents of the bin with a shovel, and carrying them to the cart, the vigorous "shoot" into which sends a fair percentage of the abomination back into the air—is to have a dust-sack always hanging conveniently open in a dry and well-cleaned cellar. The dustmen can then, without scattering a grain, carry off sack and all, bringing the sack again when emptied, and meanwhile leaving another in its place.

Another admirable plan is the circular galvanised iron movable dustbin, with close-fitting cover. These are specially useful in chambers. But it is well to impress upon servants, clerks and others, that the chief utility of the cover lies in its being kept on the top of the bin. It may be ornamental, standing up against the wall, but it is not practically useful.

These portable dustbins should *be* portable—that is to say, they should not be bigger than one man can comfortably carry when full.

Disinfectants again are as favourite in the sanitary, as "germs" in the scientific, or peacock-blue in the æsthetic world. And they are very good things in their proper place. But their proper place is not the dustbin.

As for their purifying its contents, that is something like pleasing the Dean and Chapter by tickling the dome of St. Paul's.

The sprinkling of a little chloride of lime or carbolic acid can really do little more than make two smells instead of one. And the "sanitary" smell being strong enough to mask the other, just affords a convenient cover for the putrefying mass below to putrefy more thoroughly, and poison its self-deluding proprietors more effectively.

"Reform it altogether." Let your dustbin be of some non-absorbent material, such as iron, and small enough to be carried bodily away and emptied directly into the cart. Then, when it comes back empty, wash it out with a disinfectant if you like. Above all, do not tolerate for five unnecessary minutes that commonest of abominations, a wooden dustbin built up against the absorbent brick wall of the house.

And—if you really desire a healthy house—do not confine your attention to the dustbins. War "to the broom" with dust everywhere.

Flock-papers are simply gigantic dust-preserves. So are curtains and portières, and hangings of all descriptions; and the heavier and rougher the material the more dust they will accumulate. The latter are too comfortable, and too pleasant to the eye to be altogether dispensed with, except by the real enthusiasts of sanitation. But every one may bear in mind their drawbacks in this respect, and make them as little mischievous as may be.

Carpets again are grand reservoirs for dust;

but to dispense with them altogether is, in this climate, too heroic a remedy for most persons.

Under a bed, however, a carpet should never be allowed to go. Nor should it ever extend to the walls of a room. A bordering of marqueterie, say from one to three feet wide, is a wonderful help to cleanliness and health, and exceedingly pretty to boot. It is a little dearer than carpet in first cost. But not much dearer than a really good carpet, and it will outwear any number. Failing the marqueterie floor, then the best arrangement is just the plain boards plainly stained and varnished.

It is an exceedingly good plan, too, to put upon castors not only beds and sofas and tables, but all heavy furniture of every description. The amount of filth which accumulates behind a cabinet or a wardrobe might well "give pause" to the most conservative anti-sanitarian.

CHAPTER XII.

KITCHEN.

Ventilation—Too much of a good thing—Attic kitchens—Stone floors — The blackbeetle — Skirtings — Cooking apparatus — Kitcheners — Open ranges — Gas cooking-stoves—Lighting torch—Hot-closet—Circulating boiler—And its jackets—Hot-water cistern—Gas cooking—Economy—" With care "—Erratics—How explosions occur—How to prevent them.

A MOST important feature in the arrangement of a kitchen is its ventilation. Thorough provision should be made for carrying off all those culinary odours, a whiff of which is so appetising, but which pall so rapidly upon the affections when the whiff is too long or too often repeated.

In the great modern club-houses this difficulty, with some others, is got over by establishing the culinary department in the attic story. But this is hardly practicable in ordinary dwelling-houses.

Where the kitchen is used only as a kitchen, and not also as a servants' hall, the floor should always be of stone. When it is to be practically the servants' dining- and general living-room, this is hardly advisable. But even then it is well to have

the outer portion of the floor flagged, with a boarded square in the centre. Special attention should be given to the skirtings, the thorough imperviousness of which is the only real protection against rats and mice, and such small deer, to say nothing of that still more objectionable invention, the irrepressible blackbeetle.

Kitchen skirtings should not be made of wood at all, but of cement.

The latest and most trustworthy information with regard to the relative merits of the various cooking apparatus is to be found in the Report of the Smoke Abatement Committee. The Committee examined no less than nineteen different kitcheners, and the results of the examination will be found tabulated in most elaborate fashion in the handsome quarto volume of Report just issued by them. Unluckily it does not seem to have occurred to the testing engineer that for purposes of comparison of result some approximate similarity is desirable in the conditions of the trial. So, with kitcheners of a cubic capacity varying from about 1500 to about 6000 cubic inches, exerting their powers upon joints varying—quite independently—from 4 lb. 11 oz. to 13 lb. 8 oz., the practical results to be obtained from these otherwise admirable tables in respect of comparative cost and speed of operation are less extensive than might have been desired. But the general verdict of "good," "bad," or "indifferent," will probably quite suffi-

ciently answer the householder's practical requirements.

"No. 1," is an anonymous range, 4 ft. wide, not requiring any brick-setting. The fire is in the middle, between two ovens. The fire door is perforated, for the admission of air above the fire; it is made double and hollow, so that the air passing between the plates becomes heated before reaching the fire. Air is also admitted from below the fire, up the outer sides of the furnace, which is of cast-iron, between gills, to meet the gases from the furnace, the air being heated as it rises. The intermixture is promoted at the point of meeting by a baffle-plate. The products of combustion pass over the oven, down the outer side, and under the bottom. The bottom is gilled, in order to better abstract the heat of the gases. The boiler, at the back, is made of steel and wrought iron, and can hold 10 gallons of water. It does not form part of the furnace. The bottom of the range is enclosed, so that the heat is retained there. Nothing is said of the quality of the work, but the percentage of loss of weight is one of the lowest of the whole number tested.

No. 2 is entitled the W. F. S. Kitchener, and is built into brickwork. The fire is supported by a rack-and-pinion motion, by means of which it may be raised or lowered as desired. The foul gases from the roaster and the oven are drawn down from the upper part and passed through the fire. No opinion is given of this kitchener either. The

percentage of loss of weight is rather above the average than below.

No. 3.—The novel feature of this—the "Stanley" Range—is its combination of the principles of open and of closed fireplaces. The fire-back is closed, and forms a retort or hopper, into which the fresh fuel is delivered, and where the gases are distilled. The gases are passed through the fire, and are so consumed. The products pass out through the sides and the back at the lower part, and thence pass under the ovens, up the outer sides, and over the top, to the flue. This range gives, with one exception, the smallest percentage of loss of any tested.

No. 4 is Sayer's Dust-Consuming Range, containing two ovens and two hot-closets; has for some reason not been characterised with regard to its work.

No. 5 is the "Treasure" Range, the furnace or fire-pot of which is of cast-iron; the sides and the back being hollow, forming air-spaces. The middle fire-bar is hollow, into which air is admitted from the ashpit. This air passes all round three sides of the fire-pot, and passes into it through slots at the top of the three sides, where it meets and consumes the smoke which rises from the fire. The fire-bars are feather-edged at the lower side to facilitate draught. The door is triple-chambered, or so divided by diaphragms as to heat the air that is admitted into it from the front, through holes at the lower part; the air being passed upwards, then

downwards, and then upwards again, before entering the furnace through slots at the upper part. The passages through the door are subdivided by gills. The gaseous products pass over the top and down the outer side of each oven. The roasting work of this range is described as being "very well," and the pastry work "well done." Loss of weight very small.

No. 6 is the "Greene" Soft-Coal Cooking-Stove. In this apparatus the furnace is made with firebrick sides and a sloping firebrick back. The grate consists of bars with numerous perforations; across the upper part of the furnace, and facing the inclined back, air in small jets is delivered upwards from a cast-iron air-duct towards the sloping back, to meet and consume the smoke. The gases pass away over the far end of the oven, which is below the furnace, then down through two flues at the back of the oven and under the floor of the oven, on each side, and back under the floor into the middle. Here the verdict on the preceding stove is inverted, the pastry being this time "very well," and the joint only "well done." The loss of weight too is larger, but still not high.

No. 7 has the curious title of the "Beebe" Kitchen Range, burning anthracite, returns to the formula of the Constantine stove, being greatest at roasting. It is set in firebrick, the sides of the fire are inclined towards each other backwards, and the sides of the ovens, one on each side of the fire, widen backwards correspondingly.

No. 8, the "Thorncliffe" Range, has two ovens, and two hot-closets below. Between these the fire is placed, formed with two thick firebricks, one next each closet. The flame passes over each closet, then under the oven above it, and then over to the flue. There is the specialty that the way out from the ovens is by an independent exit direct into the outer flue; so that the ventilation of the oven is not liable to be interrupted by the regular draught of the range. This range is noted as "fair" in its pastry work, the roasting being "very well done." The loss of weight is small.

No. 9, the "Eagle" Range, is only accredited with doing its roasting "well," while the loss is a little heavier. Its pastry work, however, seems to have been "very well done." The front bars are upright, the grate is hinged at the back, and is movable up and down at the front, so as to increase or diminish the body of fire. It is let down for roasting; lifted for baking in the oven or for boiling. The flame passes over the top of the oven and down the outer side, and thence to the flues behind.

No. 10.—The specialty with this (the "Engert") range consists in the mode of feeding the fire from the coaling-box at the back, in which fresh coal is deposited. The box is moved forward as required, by means of a lever. The waste here jumps up to a rather large percentage, the quality of the work being the same as that of the preceding range.

No. 11.—The fire in this range is of such a size that meat can also be roasted in front. With

the object of preventing an excessive consumption of fuel, and to keep the hot plates and ovens heated by a small fire, the fireplace is fitted with a rising bottom, movable vertically by a rack-and-pinion motion, which can be raised as the fuel burns away. The waste is small, the roasting being noted as "well done." The pastry, however, is only "fair."

No. 12.—In the "Radiator" Range the fireplace is circular, and projects to the extent of a half-circle beyond the front of the range. The gases pass through a narrow opening horizontally into a combustion-chamber at the back, for the consumption of smoke, whence they pass over and under the ovens, one on each side. By the projection of the fireplace, places are provided for three joints roasting at once in addition to the roasting ovens; and the ovens are not exposed to the direct heat of the fire. Both the roasting and the pastry work of this range are noted as "well done," the percentage of loss in roasting being small.

No. 13.—The Dutch Oven, has its fireplace above. Air is admitted through grates all round the fireplace, to perfect the combustion. The draught from the fire descends on both sides of the oven, reuniting at the bottom, and proceeding thence to the chimney. There is no boiler, but there is a coil of pipe within the fireplace surrounding the fire. The ends of the pipe rise to the cistern above. The roasting of this range is noted as "well done," with about an average percentage of loss of weight, the pastry work as only fair.

No. 14.—The "Smoke-consuming Kitchener's" chief specialty is in supplying fresh fuel, which is placed in a small trough or tray in front at the bottom of the fireplace, and is pushed in underneath the incandescent fuel by means of a hoe-shaped or flat-faced feeder. Thus the gases distilled from the fresh coal pass upwards through the live coal, and are, to a great extent at least, consumed. This range is adapted for cooking in front of the fire as well as in the oven. The average loss here is rather high. The roasting is described as well done, and in front, very well done. No verdict is passed in either this or in any of the following cases upon the merit of their pastry.

No. 15.—The "Gem" Portable Cooking-Stove has its fireplace and oven side by side. The flue passes over the oven direct to the chimney. The sides, back, and bottom of the stove are cased in an air-jacket. The side of the oven next to the fire is protected by a cast-iron plate, which is kneed so as to pass into the lower air-jacket, under the bottom of the oven. By conduction, the plate assists in heating the oven. For the larger sizes the flue is carried entirely round the oven. Here the waste is low, and the work "well done."

No. 16.—The "Times" Portable Cooking-Stove is constructed to burn anthracite. The front of the fire is made in three parts, to slide in and out: the lowest part being upright bars, the middle part a plain plate, and the upper part the feeding door. The grate at the bottom is sloped, being higher at

the back than at the front. The area for air passage is thus augmented as compared with a horizontal grate, and the fuel is thrown forward to the front as it is consumed. The middle plate becomes very hot, and is available, in conjunction with the lower bars, for roasting in front. The same may be said here, though the loss is a little higher.

No. 17.—In the "Court" Stove the air for feeding the fire comes from the roof of the range, entering a long narrow opening there, passing down a pipe at the back to the ash-pit, whence it passes, warmed, up through the fire The front of the range is thus ventilated, drawing off the fumes and vapours which rise to the upper part. The oven is supplied with heated air for ventilation. The air for this purpose is taken into the narrow space between the fire-place and the oven, passing up one side of a partition, and down the other side, and into the oven at the lower part, whence it passes off at the upper corner to the flue. There is a cast-iron boiler at the other side. The waste here is small, but the joint "under-done." It may be noted, however, that the range is one of the smallest experimented upon, and the joint one of the largest.

No. 18.—The "Falkirk" Smokeless Close-fire Kitchener has a high "waste" percentage, but its roasting "well done." The range is heated, on a modification of Dr. Siemens' system, with coke and gas. The fireplace is backed with a firebrick slab. The bottom grid reaches all the way from back to front, and consists of a series of very deep gills,

between which, being hot, the ascending currents of air are heated before entering into combustion. The gas jets are placed in a row, in front, at the level of the grate, and they are directed inwards at the angle of 45°, into the body of the coke.

No. 19.—To the above may be added an ordinary range, the specialty of which consists in under-feeding by means of a square box having a movable floor, and pivoted at the lower part, on which it is swung outwards to be filled with coal. When filled, it is replaced under the fireplace, and the fresh fuel is pushed up under the live coal; the combustible gases passing through it to be consumed. The results of the trial appear to have been crowded out of the table, which is quite silent on that head!

Speaking generally, the Report says that the conditions of the kitcheners varied considerably, with regard to dimensions, as well as to capacity; that those which were most economical in fuel were —as might have been anticipated—amongst the largest. In respect of smoke-prevention, No. 10 made the lowest smoke-shade with bituminous (hard steam) coal. Next comes No. 19. In No. 10, the coal was gradually distilled, and fed from the back; in No. 19 it was under-fed; and the minimum of smoke in these instances is readily accounted for on the principles already explained in the Report on Open Grates and Close Stoves. No. 5, No. 1, and No. 15, used the smallest quantities of fuel, in virtue of their superior utilisation of

heat. The excellent performance of the Falkirk Iron Company's kitcheners, burning coke with gas, is due, no doubt, to the employment of gills of great depth as fire-bars, and the preliminary heating of the air and the gas brought into combustion, on Dr. Siemens' principles.

In respect of gas cooking apparatus—

Thirteen gas cooking-stoves were tested for roasting joints from the sirloin, and for baking puff pastry.

The stoves were of four types: 1st, having jets of luminous gas placed inside at the bottom; 2nd, luminous gas jets inside at the top, from which the heat was communicated by radiation and by reflection; 3rd, either luminous or atmospheric jets outside the oven; 4th, atmospheric jets inside at the bottom.

No. 1, Charles Wilson (type 4).—A row of atmospheric jets at each side. It boils by means of atmospheric jets at the top. It is jacketed by an enclosed air-space 1 inch wide; the door is packed with slag-wool. The joint was "fairly," and the pastry "moderately" done. The loss on the former rather high.

No. 2, J. C. Stark & Co. (type 3).—Six Bray's jets in two rows, framed to swing outwards or under the oven as required. Atmospheric gas is used for boiling, &c. The stove is encased with slag-wool 2 inches in thickness. Joint very well done, with medium percentage of loss. Pastry good.

No. 3, Browne & Co. (Beverley & Wilde), (type 4).—Three rows of atmospheric jets inside, at the sides, and the back, with atmospheric jets at the top for boiling, &c. Lined with 1-inch tiles, and enclosed with a 2-inch layer of slag-wool. Joint well done, with exceedingly low percentage of loss. Pastry fair.

No. 4, Waddell & Main (type 1).—"Universal Domestic." Four rows of jets, one at each side, and front and back. Lined with fire-tile. Work same as preceding, but loss rather high.

No. 5, G. J. Cox (type 4).—"Regenerator" Gas Stove. One side of the oven is coated with slag-wool; the other side is formed with an air-space in which the air for supplying the burners is previously heated. Three rows of atmospheric jets are placed at the sides and back, inside. Luminous jets at the top for boiling, &c. Cased in slag-wool 2 inches in thickness. Rather high loss, and meat still under-done. Pastry "fair."

No. 6, B. Giles (type 3).—Four luminous Bray's burners at one side only, next a narrow boiler, which forms one side of the stove, and has a capacity of five gallons. The burners can be swung outside when required. The other side and the back are cased by an enclosed air space. Loss medium. Joint well done, pastry fair.

No. 7, Billing & Co. (type 2).—A reflector stove, having luminous jets at the top, for which a row of holes is made in the pipe, half of which can be lit at a time. Atmospheric gas is used for boiling, &c.

No extra casing. Same results as preceding, but very low percentage of loss.

No. 8, W. Sugg & Co. (type 4).—Two rows of atmospheric jets at the bottom, one on each side. The joint was roasted on a spit in a copper cylinder placed in the oven, in which the spit was turned by means of clockwork. Atmospheric gas was used for boiling, &c. Joint well done, but loss no less than 23 per cent., as against 5 per cent. in the preceding case, and 4 per cent. in that of No. 3.

No. 9, H. & C. Davis & Co. (type 4).—Two rows of atmospheric jets, one at each side. Atmospheric gas is used for boiling, &c. Encased with slag-wool 1½ inch in thickness. Joint very well done, but loss rather high.

No. 10, J. Dean & Son (type 3).—Two atmospheric burners, one to the right at the bottom, and one to the left at the top; so that the temperatures at the top and the bottom can be regulated independently. The flame of the lower burner circulates through a flue covering the bottom of the oven, the left-hand side, and part of the back. The flame of the upper burner circulates between the top of the oven and the hot plate, from end to end, to and fro. The gas and air for combustion are mixed in a chamber covering the upper part of the back of the oven. The burners are 12 inches long, 6 inches deep, and 1⅛ inch wide, on the principle of the Davy lamp reversed, so that there is no lighting back. They give a sheet of flame 11½ inches by ¾ inch wide,

and from 4 inches to 6 inches high. Joint well done, with moderate percentage of loss.

No. 11, S. Leoni & Co. (type 4).—Three rows of atmospheric jets at the sides and back. It is encased with slag-wool ¾ inch in thickness. Joint well done, but loss very high.

No. 12, W. Sugg & Co. (type 1).—In this test, the copper cylinder alone (*see* No. 8) was employed for the test, not being placed in the oven. Two rows of luminous jets were burned inside the cylinder, one at each side. The joint was turned on a spit by clockwork. Joint very well done, and loss moderate.

Although the use of gas stoves for cooking purposes dates back to within a few years of the introduction of coal gas, it is only within the last few years that they have come into anything like general use. The high cost of coal, the extravagant use of fuel which the modern "kitchener" entails, the trouble of keeping it clean and in order, the heat given off into the kitchen, the excessive amount of smoke poured into the atmosphere outside, and the continual expense of renewing the parts burnt away, have all tended to bring gas stoves more and more into requisition.

The difficulty until quite recently has been to obtain a gas stove of good quality which would do plain or high-class cooking as perfectly, as cheaply, and as surely as the coal and charcoal apparatus it was called upon to replace.

The makers, as is their wont, have aimed rather

at a low price than excellence, and the consequence is that gas cooking has got a bad name, and finds it hard to get rid of it.

For a private house the apparatus required in kitchen consists of the following :—

A gas roaster for roasting meat, game, baking pastry, bread, cakes, &c.

A hot plate with grill attached for stewing, boiling, frying, making toast, grilling chops and fish, bacon, &c.

A hot closet for heating plates, dishes &c.

A hot water circulating boiler for supply of hot water to baths, sinks, &c.

The gas roasting oven should be lined with enamelled tiles of light colour—in preference to enamelled iron, which chips and becomes very discoloured and dirty looking. These tiles reflect the heat, are easily cleaned, and readily renewed.

A well-made thermometer fixed in the door is a much surer guide to the required temperature of the oven than the opinion of the cook. As she will in time admit—if you do not force the fact on her attention. The gas-burner inside should, in moderate-sized ovens, be in two parts, so that half only need be kept alight when the roaster is thoroughly hot. Its distance from the dripping tray should be sufficient to prevent the quality of the dripping being injured by the heat.

The colour of the flame when burning perfectly is a pale blue, inclining to puce at the extremity.

The outside of the roasting oven should be covered with polished mahogany, like the cylinder of a well-made steam engine.

Particular care is required in the ventilation of, and the length of flue from, the oven. If the flue be too long much waste of heat will take place; if too short the cooking will be unsatisfactory.

The gas hot-plate, whether fixed over the roaster or apart from it, should be in one piece of cast-iron, with as few working parts as possible. Atmospheric ring burners of various sizes and a special grilling burner should be attached; and all brass taps, union joints and air-chambers should be of the best and strongest make.

A portable gas-lighting torch, with flexible tube, should be provided to save the inconvenience, waste and dirt arising from the use of tapers.

The hot-closet is best made with a cast-iron top and base, and fitted with sliding doors. Two or more open wrought-iron grated shelves should be provided, and a "baffle" plate of sufficient thickness over the gas burner in the bottom, to prevent injury, by overheating, to a dinner service of value.

The circulating boiler should be of copper, and surrounded with several jackets, to prevent waste of heat. The greatest facility should be provided for cleaning out the boiler.

The pipes leading from the boiler and the supply cylinder or hot-water tank should be carefully coated with non-conducting composition and cased with wood.

The hot-water cistern in a private house need not contain more than 40 gallons of water.

The ordinary boilers with wrought-iron jackets are most extravagant in the use of fuel; on the other hand, the properly jacketed boilers, while economical, require care in lighting.

The quality of cooking in a high-class gas apparatus surpasses anything that can be done in a coal apparatus. For cleanliness, convenience, and comfort to the attendants it is of course unapproached.

The cost of cooking by gas is "with care" less than the cost of cooking with coal. At Bayley's Hotel, S.W., for instance a gas oven has been fixed to take the place of a kitchen range. And it has been found that while the quality of cooking is all that can be desired, the cost of gas is about two shillings per week less than the cost of coal. And this is under circumstances where the gas cannot be used in the most economical manner.

This oven is one patented by James Slater & Co., of the Holborn Engineering Works, whose workmanship seems to call for special commendation.

It may perhaps seem superfluous to mention that the qualification "with care" does not contemplate the leaving the gas in full blaze for an indefinite number of hours after the cooking has been accomplished. The difficulty will be found to lie in impressing this elementary detail on the mind of the cook.

Another drawback to the use of a gas apparatus

is its tendency, under the strong provocation so frequently applied by the British domestic, to lose its self-control, and fly out at the kitchen window, taking with it the dinner, and possibly the cook. Even the latter is often a loss—the former always so; and there are the subsidiary annoyances of broken windows, inquests, and so forth.

The chief factor in these irregular proceedings is a certain stop-cock, by which all the different burners can be turned off at once. This is used at night, and the various secondary taps left turned on. Then, next day perhaps, a kettle has to be boiled. The gas is turned on again in the same way it was turned off, the burners inside the roaster being quite forgotten. And so the roaster gets filled, the gas leaks out till it catches at the lighted ring, and the explosion follows. If the cook survives she probably remembers in future to turn out the small taps as well. But if she does not the experience is thrown away.

The simple plan is to remove the main stop-cock altogether. Then if you want to get rid of your cook, give her a month's wages and let her go. It is far less annoyance, and in the end cheaper.

CHAPTER XIII.

HOUSE-HUNTING.

Advertisements—House agents—The *rôle* of an agent—His conscience—Making things pleasant—"Carefully seen to"—Disarming the foe—Definite statements—Corroborative evidence—Personal verification—Room or cupboard?—Purchase-money — Rent — Premium — How to estimate it—Rise in value—Increased demand—Improvements—The reason why—Rates—A question to be asked—A monotonous answer.

THE preceding chapters have applied equally to either condition, that of the househunter or of the householder. So far as concerns the situation, structure, and arrangement of a man's house, it matters little to the argument whether the proprietorship be an actual fact, or merely an as yet unrealised potentiality.

But there are considerations which affect solely the househunter, as there are others whose interest practically begins only when his period of probation has entered upon the householding stage. Let us take first a glance or two at the former.

His first trouble will be with advertisements; his next—and they are closely of kin—with agents.

As a rule, the less he believes of what either of them say, the better for his ultimate peace of mind and comfort of body. People are too apt to consider that agents—other people's agents of course—are persons whose business it is to give all required information about the property. This is pure delusion. It cannot be too clearly realised that an agent is simply a person whose business it is *to sell or let* the property at the highest price he can by legitimate means get for it.

And the recognised limits of "legitimacy" are in this case very wide and exceedingly elastic. The licence practically assumed is, it need hardly be said, considerably wider, and of an elasticity as nearly as possible exhaustive.

And the law's maxim, be it observed, is *caveat emptor.* The childlike confidence which says, "Oh, Mr. Plausible, are not these walls very damp?" and accepts with enthusiasm Mr. P.'s assurance that the great green stains are due solely to perverted ingenuity on the part of the paperhanger, is very touching and very sweet, but will not obtain a subsequent verdict in a court of law.

So, too, with what would seem on the surface to be actual plain statements of fact. No one has any practical idea of the extent to which the noble art of ambiguity can be carried till he has gone—and gone intelligently—through several experiences of this kind. In saying nothing, with an air of absolute authority a really good agent might give lessons to the authors of the Queen's Speeches.

It should be borne in mind: (1) that it is his business to "make things pleasant;" and (2) that he understands at least this part of his business, —and will do it.

And, after all, it is Emptor's own fault if he be taken in. It is very easy, with a little practice, not to swallow whole what is told you. When Mr. Plausible assures Mr. Emptor that this has been "carefully seen to," and that "thoroughly overhauled," and "most particular attention paid" to something else; there really is no reason why Mr. Emptor should not at once gather, from the charming vagueness of the statement, the very certain fact that nothing has been done about which a definite statement could profitably be made.

Three simple rules will suffice to render this dangerous creature quite harmless.

1. Never accept any statement which is not entirely precise and definite. Do not waste so much as a thought upon such a statement, for instance, as that "everything has been done." The question is, "*What* has been done, and *how?*"

2. When the question has been answered, see that the answer is "in black and white," and supported by some sort of evidence. In a statement, for instance, as to work done to the drainage system, the architect's specification and the builder's bill are very wholesome ingredients.

3. When the statements are of a kind that admit of personal verification, verify them—or otherwise, as the case may be. For instance, if the agent has

assured you that there are five-and-twenty "rooms" in a house, exercise your arithmetical powers, if sufficient for the purpose, in checking the assurance. There is really no practical advantage to be gained by waiting for possession to ascertain that there are only twenty-three and two dark cupboards.

The various points to be looked to in respect of General Requirements (p. 6), Situation (p. 18), Soil (p. 29), Construction (p. 35), Water Supply (p. 44), Drainage (p. 57), Ventilation (p. 75), Warming (p. 95), Light (p. 107), Kitchen Department (p. 128), and Housemaid's Department (p. 123), have all been fully discussed in the preceding chapters.

Comes next the question of rent, or, as the case may be, purchase-money or premium.

Purchase-money of course represents, or should represent, the actual (very possibly "fancy") value of the property, freehold, copyhold, leasehold or other.

Rent is the interest on the purchase-money, at —according to present English rates—from four to ten per cent.

Premium is, or should be, the capitalised equivalent of the excess of present rental value beyond the rent actually covenanted to be paid. For instance: A transfers to B the last ten years of a lease at £100 per annum. The property is now worth £150. A has therefore a claim for premium

to the extent of ten years' rental of £50 per annum, or (say) £375.

The value of property may be raised by various causes. As for example :—

1. Increased demand, not kept pace with by increased supply. In the "business" and "fashionable" parts of London, for instance, this cause operates continually, and will operate for an, at present, indefinite period.

2. Improvements in the premises since the rental was fixed.

3. Increased facilities of communication.*

4. Local improvements, raising the general value of property in the neighbourhood.

When a premium is demanded there can never be any real harm in inquiring the grounds upon which the demand is based. And in taking over the remainder of a lease it is a wholesome practice to consider the question in close connection with the covenants therein contained.

Another point of considerable importance as affecting the value of any town house is the question of rates. In our happy-go-lucky "system" of municipal government a few yards of distance may make the difference of many annual pounds in this respect.

This is a subject upon which the agent's information may be characterised as monotonous. The

* Whether this is to be counted as a gain or not must depend to a considerable extent upon circumstances—and tastes.

only thing he ever knows about is that "the rates are low." If too-confiding Mr. Emptor ask him afterwards whether he considers nineteen and elevenpence three-farthings in the pound low, he will reply, "Very low indeed—considering." On the whole it is, perhaps, better that the "considering" should be done first.

CHAPTER XIV.

LESSORS, LESSEES AND THEIR LIABILITIES.

A caution—Landlord's law—A light liability—Who shall re-roof?—An amicable settlement—Burnt out—Awkward for the tenant—Precautions—Repairs—A pugnacious tenant—A landlord's remedy—A recalcitrant landlord—The tenant's redress—Repairing covenants—Repairing without leave—Expiring leases—Winds and great winds—Other people's iniquities—Poor rate—Landlord's rates — Tenant's rates — Uninhabitable houses — The unclean insect—Notice to quit—A final caution.

ONCE more—and in this case very emphatically—the caution: *these are hints.* An exhaustive view of the whole question of the law of landlord and tenant, with all the multifarious modifications of that relation in the way of tenants at will and tenants in fee-simple, tenants for years, with or without the soft impeachment of waste; tenants in common and joint tenants; or tenants by statute-merchant, by staple or by elegit; yearly tenants or tenants for life; tenants in tail or tenants out at elbow, might possibly, as Bishop Wilberforce maintained of the writings of the Fathers, be com-

pressed into a single volume. But, as his lordship was fain to admit, it would certainly be a "very, very, large volume." Into a single chapter of a pocket volume of "Hints" an hydraulic engineer would probably hardly think of packing it. Enough if we can give a few practical suggestions on the points most commonly arising in the ordinary misunderstandings of everyday life.

And first it may be assumed that as a general rule the law will be on the side of the landlord. This is natural, because it was the landlords who had most to do with the making of it. It is also fair, because the landlord is the party with the larger interest—the more exposed to injury and the less able to resist it.

Speaking generally, the landlord is not, unless by special stipulation, or recognised local custom, bound to do anything at all. If the roof come off, he is not bound to put it on again. It is no affair of his.

Possibly not the tenant's affair either.

Then whose affair is it? From the legal point of view, nobody's. Why should it be? It was Mr. Emptor's business to take his pig out of its poke, before concluding the bargain, and satisfy himself that it was a sound and healthy pig, with the due muster of legs and hands and loins of pork, and a proper curl—if he were particular about the curl—to its tail.

The question of practical liability in such case resolves itself into one of simple endurance. Both

sides, so to speak, are handicapped. The landlord has his property damaged by exposure to weather; the tenant is personally rained upon. But the tenant can put up an umbrella, and the landlord can't. Or, at all events, its elevation will not be of any practical protection to his pocket. Moreover, the tenant can go out of town till the rain be over, and the house can't.

An appeal to your landlord on these grounds—gently pointing out that you have no tendency to rheumatism yourself, and are passionately fond of fresh air; but that you are really pained by the sight of the damage which is accruing to the property of a gentleman to whom you are under such never-to-be-forgotten obligations, will rarely fail to carry conviction.

It is otherwise when the house has been burned down, and the landlord by whom it has been insured has duly received the insurance money.

Because in such case the landlord's interests are, as may easily be seen, directly opposed to the rebuilding of the premises. The two or three or more thousands of pounds received from the insurance office will bring in five or six per cent. if placed on mortgage on another house. If fooled away in rebuilding the burned one before the term is up it will bring in nothing. Because the rent has to be paid anyhow.

And the moral of this—otherwise doubtful piece of morality—is: either see that the necessary covenants are inserted in your lease, or don't have

your house burnt down. There is no harm in combining these precautions.

And remember that even with the most ample covenant the landlord is not bound to reinstate the premises as they were *when they were burned*, but only as they were *when he let them.**

Where, however, the mutual agreement has been made that the landlord shall put the premises into repair, and the tenant shall keep them so, the tenant's liability does not begin until the landlord's has been fulfilled.

In one respect the tenant "has the whip-hand" of the landlord. While his tenancy lasts, and the rent is paid, the house is *his* castle, not the landlord's. And the landlord can't come in to do repairs if the tenant prefers to go unrepaired, but must bring his action and take his remedy in that way.

On the other hand, if the tenant wants to be repaired, and the landlord won't repair him, it is not open to the tenant to walk out of the, let

* A caution may here appropriately be given against a very prevalent delusion on the subject of "partial" insurance. This is a form of economy which the law does not recognise. *Porcus integer aut nullus* is the legal maxim, and its application is invariable. If you insure at all, you are supposed to insure to the full value of the whole property insured; and a partial loss is only entitled to a *pro ratâ* compensation. For instance: Your furniture is worth £2,000, and you insure for £1,000. By-and-by your housemaid sets the place on fire, and half the furniture is destroyed—value £1,000. But the insurance office will pay you not the £1,000 which you have lost, but the *half* of the £1,000 for which you insured.

us say, roofless house, however stringent the covenants may be which bind his landlord to re-roof it. He must put on his mackintosh and bring an action, in his turn, for breach of covenant.

Where there is wisdom on both sides, covenants will be introduced providing for these several cases, and also freeing the tenant from the necessity of paying rent during such time as his house may be uninhabitable by reason of having been burned down.

A further covenant may be introduced authorising the tenant, in landlord's default, to do needful repairs himself and deduct them from the rent. But let a tenant beware how he follow this line of procedure *without* such covenant. Because, though he will probably find no serious objection raised to his doing of the repairs, the deduction from the rent will probably be regarded from a different point of view. And he has no right whatever to make any such deduction.

It is a delusion to imagine that the repairing covenants of a lease become obsolete at its expiration if the occupancy be still continued. In such cases the liability to repair continues on the same lines as before. It will, however, in most instances, be construed by the courts with somewhat less strictness.

There are certain subtle distinctions between damages done by "wind," and by a "great wind," or a "tempest," which to the real amateur of litigation may often afford excellent sport. But

he had better under any such circumstances consult a solicitor—if only to ensure that there shall be some one who will profit by it.

There are other liabilities also, some of them very rarely recognised as such until they actually accrue.

There are liabilities, for instance, left behind by the previous tenant, some slight inquiry as to whose character and credit may always assume with advantage a place among the preliminary precautions of the prospective householder.

An incoming tenant is liable only for a fair proportion of a poor rate made previous to, but not fully paid at, the time of the commencement of his occupation.

The term "poor rate," as used in the last preceding paragraph, means the assessment for the relief of the poor, and for the other purposes chargeable thereon according to law; and in the metropolis the term poor rate extends to every rate made by the overseers on the same property as the poor rate.

No universal rule can be stated as to liability of incoming tenant for payment of overdue local rates at the time of the commencement of his tenancy; but, as a general principle, he is liable to his fair proportion only. It is in all cases wise, however, to ascertain before taking a house, what, if any, rates are due and unpaid.

In default of express agreement to the contrary, the landlord is bound to pay, or allow to his tenant

such sums as he may pay for income tax (schedule A), land tax, sewer rate, and charges for making new roads and streets, and remedying nuisances caused by defective construction of houses or drains.

Tenant, in default of express agreement to the contrary, is bound to pay poor rate and inhabited house duty and ordinary rates and taxes not mentioned in preceding paragraphs.

Even where the tenant has agreed to pay all rates and taxes he is not liable to pay sewer rate or the expenses incurred by the local authority in executing works to remedy nuisances occasioned by defective drainage of premises or other like cause, or in sewering, levelling, or paving a new street on which premises front, adjoin, or abut, unless apt words are introduced into the agreement showing that it is the intention of the parties that the tenant should be liable.

In leases the tenant usually covenants expressly to pay sewers rate, and a covenant by the tenant to discharge all duties, parliamentary, parochial, or otherwise imposed upon the landlord or tenant in respect of the premises, has been held to throw upon the tenant the liability for such expenses of the local authority as mentioned in the last preceding paragraph.

In the case of an unfurnished house the tenant has no remedy against the landlord if, after entry, it should turn out to be uninhabitable, unless the tenant was induced to take the house by misrepre-

sentation amounting to legal fraud on the part of the landlord or his duly authorised agent.

In the case of a furnished house, the landlord, it would seem, impliedly warrants it to be fit for immediate occupation, and if it be not so the tenant can leave it, and successfully defend an action for the rent.

Whether a furnished house be or be not uninhabitable, is a question of fact for a jury. A furnished house much infested by the unclean insect has been held to be uninhabitable.

In default of express agreement to the contrary, even where the landlord undertakes to insure, the tenant is liable to continue paying rent for the remainder of his term, notwithstanding that the premises out of which the rent issues may be destroyed by fire, explosion, or otherwise. It therefore behoves a tenant either to provide in his lease against this liability, or to insure the amount of rent he may have to pay in addition to the value of the house.

Notice to quit is not necessary in order to put an end to the tenant's term where he holds for a fixed or limited period, or until the happening of a certain event.

Notice is necessary in the absence of express agreement to the contrary, where the tenant holds from year to year, quarter to quarter, month to month, week to week, or other indefinite period. In default of express agreement to the contrary, a yearly tenant must give six months' notice to quit,

expiring with the current year of his tenancy, i.e. at the time his tenancy commenced ; and a quarterly, monthly, or weekly tenant must in like manner give a quarter's, month's, or week's notice, expiring on a quarterly, monthly, or weekly day corresponding with the day of the quarter, month or week, on which his tenancy commenced.

The landlord of a house, unless he has expressly agreed to repair, is not under any obligation to repair a house he may let, and notwithstanding that the same may become uninhabitable for want of repair, the tenant will not be excused from payment of rent.

The tenant from year to year of a house not under express agreement to repair is nevertheless under some liability in respect of repairs. Thus he must repair injuries resulting from wrongful acts, or improper use of the demised premises by himself or his servants ; and Lord Kenyon laid down the duties of a tenant from year to year as to repairs in these words: "A tenant from year to year is bound to commit no waste, and to make fair and tenantable repairs, such as putting in windows or doors that have been broken by him, so as to prevent waste and decay in the premises. But in the present case the plaintiff has claimed a sum for putting a new roof on an old, worn-out house. This I think the tenant is not bound to do, and that the plaintiff has no right to recover."

Usually, tenants who hold under written agreements or leases make special contracts with their

landlords as to repairs, and these are generally of a very stringent character.

Tenants should be very careful not to enter into, or agree to enter into, a lease containing the ordinary repairing covenants, without first having the premises proposed to be demised carefully inspected by a competent surveyor. Otherwise they may find that they have contracted "to repair, uphold, and maintain" a hopelessly rotten building; or, in other words, practically to rebuild it, or at any rate to incur a cost in repairs never contemplated by them.

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